# Comptessed Air Magazine FEBRUARY 1958

FROM INSIDE

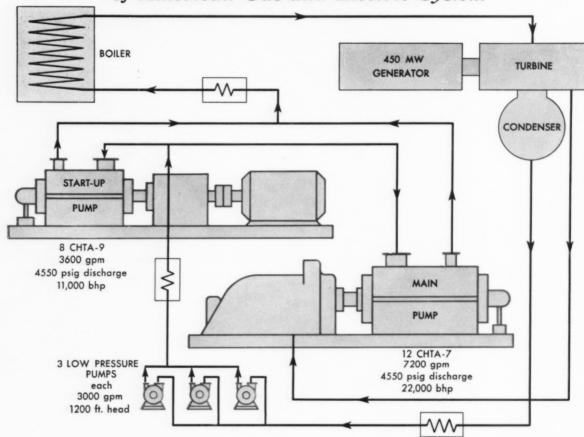
Greceful pattern formed by laminated arches for planetarium

**VOLUME 63 • NUMBER 2** 

**NEW YORK • LONDON** 

# WORLD'S BIGGEST BOILER-FEED PUMPS

will serve two 450 MW Generating Units of American Gas and Electric System



I-R Pumps rated 22,000 hp and 7200 gpm will set new world's record for power and capacity A merican Gas and Electric System will make power-plant history with the construction of two tradition-shattering 450 MW generating units—one for a new station operated by the Indiana & Michigan Electric Company and the other for Ohio Power Company's Unit No. 5 at Philip Sporn Station.

Both of these installations will be served by Ingersoll-Rand boiler-feed pumps – 5 units each, connected as shown in the diagram above. Particularly noteworthy is the 7-stage Class CHTA main boiler-feed pump, the largest unit ever ordered, driven by a 22,000 hp steam turbine.

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10-70

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Write for complete information on any of the Staynew filters illustrated. Be sure to specify Bulletin Number or Numbers. Consult Dollinger Engineers on any special filtration problems—no obligation. Dollinger Corporation, 7 Centre Park, Rochester 3, N.Y.

del HE (Sump)

**Bulletin 330** 

### PIPE LINE FILTERS



Model CPH Pipe Line Filte Bulletin 200

Model AAPHS

(Absorption) Pipe Line Filter

Bulletin 200



Model CVH (Vacuum)
Pipe Line Filter
Bulletin 200



Model HPH and AHPH (High Pressure) Pipe Line Filter Bulletin 200



LIQUID FILTERS



Model ELS (Pressure) Liquid Filter Bulletin 300

Model IDR (Ground Level) Air Intake Filter Bulletin 100

### AIR INTAKE FILTERS



Model DS (Silencer) Air Intake Filter Bulletin 100



Model D (Outdoor) Air Intake Filter Bulletin 100



Model C (Indoor) Air Intake Filter Bulletin 100

### VENTILATION FILTERS



Electro-Staynew Mist Collector Bulletin 420



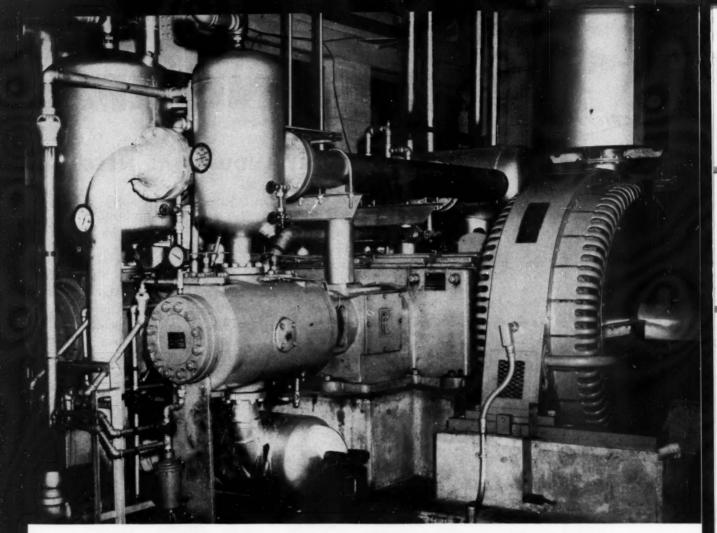
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### Compressed Air Magazine

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### ON THE COVER

THE GRACEFUL pattern on the cover of this issue is formed by 40 laminated wood arches making up the dome of the planatarium at Spitz Laboratory, Yorklyn, Del. The diameter of the building is 50 feet, and the height of the arch is almost 26 feet above the spring line. Laminated wooden beam construction is a rapidly growing segment of industry, and the story beginning on page 14 details some of the background and methods of one of this country's leading laminated beam manufacturers besides describing its use of compressed air power.

VOLUME 63 NUMBER 2

February 1958

### FEATURE ARTICLES

Page 14 Factory-Grown Timbers-R. J. Nemmers

One of Minnesota's fastest-growing companies is Rilco Laminated Products, Inc. They are turning out laminated wood timbers that are finding new industrial and architectural uses throughout the world. This is the story of the product and the 17-year-old firm that makes it.

20 Secluded Skaguay-Carey Holbrook

More than 50 years ago, a small hydroelectric plant was built in an isolated canyon in southern Colorado. It still delivers its share of power to the Southern Colorado Power Company network. Some details are also given about a companion station that undertook the furnishing of compressed air as well as power.

24 Heritage In Stone-S. M. Parkhill

In the Black Hills of South Dakota, nearly half-way between the Atlantic and Pacific coasts, in the United States, stands an unfinished memorial to four presidents. Although millions look at this colossal sculpture annually and wonder at its magnitude, few realize to what extent air power was required in its execution.

26 Balloons Raise Aluminum Structure

Unable to use conventional crane lift, a geodesic dome in Kansas was raised by air power, thus enabling construction to be completed in 22 hours.

28 Pressure-Cylinder Manufacturing Changes

Containers for gases stored under high pressure are being built by a new process and are assuming unusual shapes.

30 Agitation Of Milk In Truck Tanks-Peter Sleight

Although agitation of fluids with air has long been popular in industry, it was not until comparatively recently that it was used in dairies to keep milk and cream from separating. Many creameries have discovered a means for accomplishing this while the collection truck is still loaded, eliminating the necessity of moving the fluid to holding tanks.

34 Big Scoop

Bathtub-sized buckets unload barges in record time.

36 Pneumatic Dunnage Commercially Available

In trying to find a more economical means for shoring cargo in box-cars, the U.S. Army devised air-filled cushions to do the job.

### DEPARTMENTS

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# Trial by fire

### DUCTILE IRON VALVES ARE THE LATEST ADVANCE IN WALWORTH'S CONTINUING RESEARCH AND DEVELOPMENT PROGRAM

This fiery demonstration is dramatic proof of Walworth's constant effort to develop better valves. This use of ductile iron — "the cast iron that can be twisted and bent" — results in new Walworth Valves that are stronger than gray cast iron valves and several times tougher. Ductile iron combines the corrosion resistance of gray iron and the strength of steel. Ductile iron valves have many times greater corrosion resistance than more expensive steel valves.

In service these Walworth Ductile Iron Valves will

solve many of the corrosion, cost and maintenance problems for the marine, petroleum, gas, and chemical industries. Ductile iron studies are just a part of the continuing work of Walworth's Research and Product Development Division.

For almost every piping job there is a Walworth Valve... in a type, size, and material to meet your requirements... Gate, Globe, Angle, Check, and Lubricated Plug Valves in a variety of pressure ratings. For more information contact your local Walworth Distributor.



In the first stage of thermal shock test, oil fire and gas flame heat a 6-inch Walworth Gate Valve constructed of ductile iron to a red hot temperature of 1350°F.

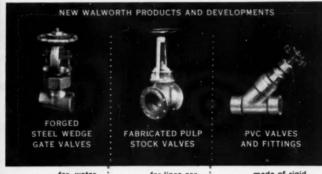


Now the Walworth Valve is quickly chilled with streams of water.

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Swinging wagon drill into position, high above roadway. General Contractor: Tri County Constructors, North Hills, Pa. Drilling Sub-contractor: J. H. Beers, Inc., Bangor, Pa.

### Project: Road Improvement Along Delaware Problem: Removing 10,000 cu yd of Limestone

Part of the road improvement program of the Pennsylvania Department of Highways called for the recent removal of some 30,000 cu yd of blue limestone from a 3.4-mile section of Route 611, paralleling the Delaware River at Riegelsville, Pa. Bethlehem 1¼-in. Hollow Drill Steel, fitted with carbide-insert bits, was used in boring blast holes.

### ADVANTAGES OF BETHLEHEM HOLLOW

Bethlehem Hollow Drill Steel saves money in rock removal jobs because it has the ability to stay on the job. This is because it is rolled from fatigue-resistant steel, and has a

centrally located, uniform hole. It has a wide quenching range. It is also easy to heat-treat for the proper balance of toughness and wear-resistance.

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BETHLEHEM HOLLOW DRILL STEEL CARBON AND DRILL STEEL CARBON AND



At its Memphis plant, Grace Chemical produces 300 tons of anhydrous ammonia per day. Three 4,000-h.p. compressors are the heart of this operation, each handling 3 different gases under varying intake and discharge conditions.

# Fire-resistant PYDRAUL AC protects huge compressor operations at Grace Chemical Co.

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Organic Chemicals Division

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FEBRUARY 1958

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with "Jimmy" Diesel-powered Ingersoll-Rand Drillmaster

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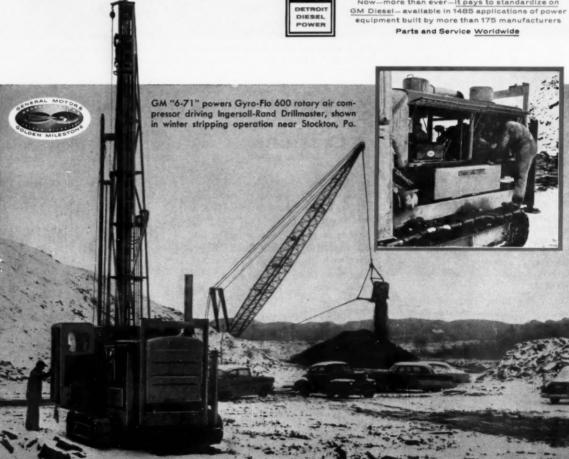
Bazley put his second General Motors Diesel-powered Drillmaster to work in 1956 and for several months this unit has operated three shifts a day. In its first 13 months, this machine drilled 74,620 ft. of 61/2" hole. Bazley's first Drillmaster, now operating round the clock near Stockton, Pa., drilled 85,007 ft. in 14 months.

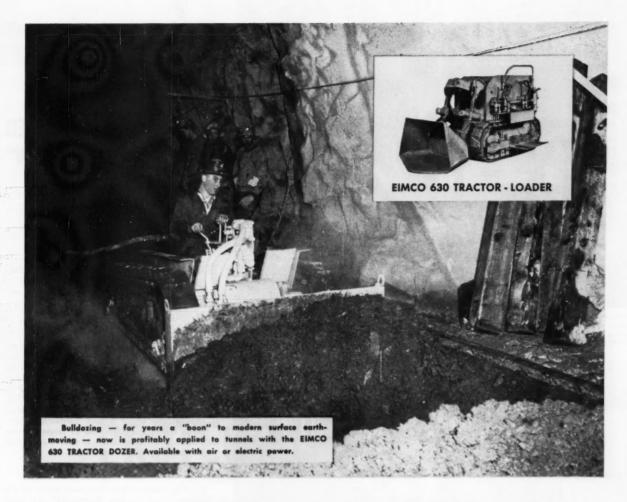
You get work done faster with equipment powered by GM Diesels because these rugged 2-cycle engines deliver a smoother, steadier flow of quick-accelerating power-in rotary air compressors; shovels or draglines; locomotives; scrapers or haulers. And as a bonus you get the high interchangeability of GM Diesel parts which cuts inventory requirements to a minimum. When you're in the market, be sure to ask for equipment powered by GM Detroit Diesel. It's money in your pocket!

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The Eimco provides "on the spot" mobility . . . no time-killing preparations. It's a constant, reliable producer that moves more tonnage, faster . . . cheaper. The Dozer permits easy selection of high and low grade ores or waste. It removes material around pillars fast and easy with no extra provisions. It works where a slusher cannot be rigged.

Eimco 630 Dozers are pushing material to raises from low headroom, flat headed stopes; leveling blasted muck at headings; cleaning various types of inverts; grading, and producing in many other ways.

If your needs call for a fast loader . . . the EIMCO 630 Excavator (inset) is your answer. Tremendous crowd, extraordinary digging action, overhead discharge and easy operation speed up handling of heavy, hard-to-dig materials. And . . . it has front-end versatility for handling scores of other jobs, economically . . . from roof bolting to drill mounting.

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These seven 900-cfm Gyro-Flo compressors, arranged for stationary mounting, meet all air power requirements for drill barge "Hornet IV". Water-cooled heat exchangers replace the air-cooled radiators normally used for portable units. Rugged dependable Ingersoll-Rand Air Starters insure quick positive starts at all temperatures on six of these units.



Ingersoll-Rand air motors raise and lower the deck-mounted stud beams that "anchor" the "Hornet IV" firmly to the channel bottom while in drilling position.



Above: The Ingersoll-Rand heavy-duty air hoists – provide the motive power on the drilling towers. Each pair of hoists is provided with a single set of centralized remote controls for easier operation.

Left: Two sets of winches, mounted on opposite ends of the barge and driven by I-R air motors, pull the "Hornet IV" to and from the drilling site between rounds by means of anchored steel cables.

## GYRO-FLO in the news

### Seven 900-cfm Units Provide ALL AIR POWER for Drill Barge "Hornet IV"



### DREDGING DETROIT RIVER

Now in operation at the lower end of the Detroit River, off Amherstburg, Ontario, the special drilling barge "Hornet IV" has fired the opening rounds in a five-year program that will deepen all connecting channels on the Great Lakes. This project, undertaken by the U.S. Army Corps of Engineers, will deepen limiting channels by about 6 feet, permitting fuller cargo loadings and the use of larger vessels, with an anticipated saving of about \$10 million per year in transportation costs.

#### GIANT DRILL BARGE

Built by Marine Operators, contractors for the Amherstburg job, the "Hornet IV" is a giant 160 ft. by 30 ft. drill barge that is blasting 6 feet of solid rock from a 6-mile stretch of channel bottom. All air power for the "Hornet IV" — for operating the submarine drills, the hauling winches and leveling posts — is provided by seven 900-cfm Gyro-Flo compressors. Also included are forty I-R air hoists and seven special I-R air motors.

### **DEPENDS ON AIR**

With 6300 cfm of dependable Gyro-Flo air power, the "Hornet IV" is drilling and blasting at the rate of one charge (500 lb. of dynamite) every hour and 45 minutes. Here, virtually everything works by air — and the ability to maintain this unprecedented blasting rate depends on the compressors. Hence service-proved performance and exceptional freedom from maintenance were major factors in the selection of Gyro-Flo units for this important installation.

For information on how Gyro-Flo air power can help you do a better job, faster and at lower cost, just call your nearest Ingersoll-Rand representative.



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### Moisture and impurities form in cross-shop piping



# PROTECT your equipment with Fulflo Filters

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toughness in impact mechanism of new power hammer

### **SOLUTION:** Nickel alloy steel—Carburize!

The parts shown in section above are the heart of the impact mechanism of Ingersoll-Rand's new lightweight electric power hammer.

They're made of 8640, a nickel alloy steel. By carburizing the parts, I-R gets a surface with extra wear resistance while retaining the very high strength of the fully hardened core to take the impact and stress of 2300 blows a minute.

Piston, crosshead and both outer and inner spring seats are made this way. They can withstand terrific, continuous pounding and shock load with a minimum of wear . . . without deforming or cracking.

Your requirements may be altogether different from Ingersoll-Rand's. But when you need a metal with the "extra" properties there's a grade of nickel alloy steel to cover practically every fabricating or service demand.

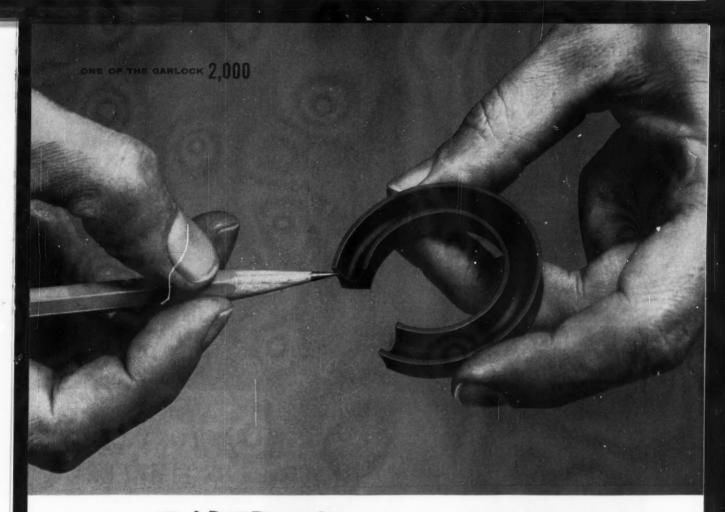
Send us details of your application and we'll be happy to help you.



New electric power hammer by Ingersoll-Rand, New York, N. Y., can be used for breaking concrete (above), stone, macadam . . . for drilling, roughing, cleaning, caulking, scaling, chipping, seaming and dozens of other jobs. Unit weighs only 12 lbs. and features an exclusive "spring floating" piston.



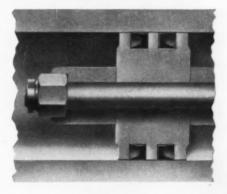
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# NEW FLARED-LIP U-CUP

Garlock's new homogeneous U-cups are designed for minimum frictional resistance in low pressure air or hydraulic cylinder applications. They are molded of synthetic rubber with flared sidewalls which also facilitate assembly, especially when cylinder bores vary slightly in size. Instantaneous sealing after sudden pressure changes is another advantage of the flared-lip design. Sizes  $\frac{1}{2}$ " O.D. to  $3\frac{3}{4}$ " O.D. are available from stock. Sizes to meet all AN6226 and JIC dimensional specifications.

Homogeneous U-cups are another part of the famous "Garlock 2,000"... two thousand different styles of packings, gaskets, and seals to meet all your needs. It's the only complete line... it's another reason you get unbiased recommendations from your Garlock representative. Call him or write for AD164.



The new Garlock 9511 U-cup Packing is recommended for pressures to 2000 psi. The flared-lip design creates an interference fit especially adaptable to applications involving sudden pressure changes. Clearance at the heel reduces friction, makes assembly easier.

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ACTORY growing or building of timbers to order is something fairly new on the industrial scene. Essentially, it is a method of laminating wood strips: the laminations are bonded with adhesives rather than mechanical fasteners; and the grain of each is aligned approximately parallel, longitudinally, with the others, rather than cross graining as is the case with plywood. The products thus formed may be straight beams, but often are curved or cambered.

Glued-laminated structural products got their start in Europe about the turn of the century although the idea was much older. In this country, with the exception of very limited trials, laminated beams weren't used until the 1930s. It was then that the United States Forest Products Laboratory initiated studies to produce design data and determine physical characteristics of such fabrications. A 46-foot-wide building using glued-laminated structural members was put up in 1934 at Madison, Wis., to aid in the research. In the following years, an infant industry sprang up, producing, for the most part, small sections for farm buildings.

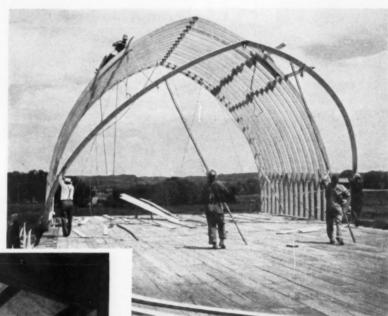
In 1936, a Forest Products Laboratory engineer inspected a great many laminated-beam buildings in Europe, some of them 30 or more years old at the time, gathering data on the strength and durability of the structural members. The results of his trip, combined with other basic research performed by the Laboratory, provided the essential know-how for a rapid expansion of the industry into commercial and heavy industrial fields. This speedy growth, in the period just preceding the Second World War,

is also closely related to the development of water-resistant, synthetic-resin adhesives. Prior to their availability, most laminating was done with casein adhesives that are moisture resistant, rather than water resistant.

The government was not alone in its concern over the development of laminated structural forms-lumber concerns were interested, and for obvious reasons. In 1933, Weverhaeuser Sales Company assigned a specialist to develop and adapt lamination to factory production. Later, the Rock Island Lumber Company, Blue Earth, Minn., a subsidiary of Weyerhaeuser, carried on extensive experiments. In 1939, Rilco Laminated Products, Inc., was organized, deriving its name from the initial letters of the Rock Island firm. Rilco today is one of the leading laminators within the United States.

The newly organized company set up shop in the basement of the Albert Lea Hide & Fur Company. The relatively small city of Albert Lea, Minn., was chosen because skilled woodworkers and adequate rail and highway connections were available. The basement plant was too small almost before production began, and it was not long before an 8000square-foot structure was obtained. Since the war, the Albert Lea facilities have grown to a floor-space total of 145,000 square feet, including an entirely separate plant several miles out in the Minnesota countryside. Approximately 250 men are now employed at the two locations.

Rilco manufactures timbers for three special markets: rafters for farm buildings; arches, beams and trusses for churches, schools, gymnasiums, stores and commercial buildings; and finished



### LAMINATED WOOD CONSTRUCTION

At the far left (center), is an interior view of Johnny's Cafe, Omaha, Neb., which was constructed with six Rico wood frames spaced 20 feet apart on centers. The arches spanned a 43-foot-wide area. Shown at the immediate left is the Temple of Aaron Synagogue, St. Paul, Minn. The structure is made up of glued laminated wood arches, purlins and beams. There are eight complete arches with a span of 62 feet 2 inches, a center height of a little more than 28 feet and a radius of 9 feet 4 inches. The 33-ply beams have a cross section of 11x253/4 inches. There are also four half arches spanning 40 feet 3 inches and having a common ridge. These were made up of 42 plies each and measured 11x3513/4 inches in cross section with other dimensions approximately similar to the complete arches. At the far left (bottom), is a view of Siegel's Market, Richmond, Va. Nine tied and one buttress laminated arches are used in this building. The radius at the center line is 90 feet 4 inches. The exterior (buttress) arch used a waterproof resorcinol glue, the interior members being made with a casein adhesive. The decking was also prepared by Rilco. The structure shown being erected in the picture above is a 36x39-foot Rilco barn. Located near Durand, Wis., the building was put up by the owner and seven of his neighbors in just 7 hours.





### LUMBER PREPARATION

At the top is shown the prepatching machine that takes out knots and other defects that might be visible in the finished lamination. Powered by Bellows aircylinders, the device cuts out the fault on the downstroke and, on the upstroke, replaces the wedge-shaped cutting with a patch of matching grain and color. The cylinder at the left clamps the board in place, and the two opposing units over the work power the cutters. A Norgren filter-lubricator under the work table serves the cylinders. The scarfing machine is shown in the other view (above). Boards come on to the table parallel to the floor, then are grasped by the air cylinder shown in the center and the work table tilts upward to present the piece to the scarfing knives at the correct angle. In this machine the cutting knives act parallel with the grain thus avoiding the raised and torn surface resulting from crossplaning. The man at the right is checking the moisture content with a portable rig. A pair of probes are driven into the board and an electrical current passed through them. The flow of electricity is an indicator of the moisture present in the wood. To meet Rilco's quality control standards, the moisture level must be in the range from 10 to 14 percent.

and semifinished wood parts, such as wagon tongues, wagon boxes, rake teeth, reel bats, diving boards and billets, for finishing by other firms.

In general, larger pieces are made in the country plant, and the smaller rafters and specialty work is done in the in-town facility. There are two lumber storage facilities used in connection with the plants, and between them there is an average supply of about 4 million board feet of lumber available. Although many different types of woods are used from time to time for specialty items, most laminating is done with

Douglas fir and yellow pine. Each has the high tensile strength and light weight essential for the job.

Only stress-graded lumber is purchased, and it must be blanked to size and custom kiln-dried to a uniform moisture content in the 10-to-14-percent range. The lumber is received, usually in boxcar lots, at a specially designed unloading and grading station. There it is put onto conveyors that carry it in front of an experienced lumber grader. After being appropriately marked, the lumber is conveyed to sorters that divert it to different parts of the yard, accord-

ing to grade. In the yards, it is stripped between layers so as to maintain the specified moisture content and prevent warpage.

As material is called for by the production departments, it moves to the lumber preparation section. There it is resawed to the required dimensions. (Most material is received as 1- or 2-inch-thick boards of random lengths and widths.) After sizing, it is edged, surfaced and then regraded, its moisture content being rechecked at the same time.

The next step in the operations cycle is to prepatch the edges of each piece. This is done by a pneumatic-cylinder-operated machine that cuts out the flaw—usually a knot—on the downstroke and, on the upstroke, inserts in the wedge-shaped cut, an interlocking patch matching the grain and color of the wood. By doing this at this point in the cycle much of the expensive hand finishing of the completed laminations is eliminated.

The laminae then move to a scarfing department where the ends are beveled. preparatory to making end joints. Rilco uses a planer for this task that cuts parallel to the grain, rather than across it. This avoids the raised or torn surfaces common to cross-grain cutting and assures a better joint. Air cylinders grasp the wood pieces as they reach the scarfing machine, clamping them into position for the cut. Then the pieces are glued together in automatic-positioning, high-frequency bonding machines in which compressed air applies the pres-Continuous ribbons of laminae are thus produced. These are cut to lengths required for the final product.

Prior to actually putting the lamination together with glue, the individual

pieces are laid up "dry." During this operation, end joints are positioned so that they are evenly distributed throughout the member-not all fall in the same plane. If several grades of lumber are to be used in the assembly, these too, are properly segregated. The laminae then move in order through a cabinet surfacer, that planes them to final thickness and assures a uniformly smooth surface, and a glue spreader.

In general the preparatory steps just described are the same for both large and small items. It is when the laminae reach the assembly floors that the techniques differ in any great degree. Small assemblies, as they come from the spreaders, are laid up in jigs equipped with pneumatic clamps. After all pieces are in place, a valve is opened and the built-up item is forced into shape, in the case of curved pieces, or squeezed together, in the case of straight ones. Then mechanical clamps are applied to hold the assembly in place during curing. When this is done, the air clamps are released and the assembly is transferred to a curing area to enable the adhesive to set up and dry properly.

In laying up the laminations for small production-line items, two like pieces usually are made up at the same time with the mechanical clamps separating them. The clamps essentially are large bolts with forged special heads and guide surfaces to hold bearing or clamping plates. They are tightened by running a nut onto the threaded section. Ingersoll-Rand Size 534 Impactools are used for this job, clamping first in the middle of each member and progressing to the ends. In earlier years, nut running was done with hand-operated speed or ratchet wrenches. The pneumatic-powered tools have made it possible for the company to boost production markedly without a proportionate increase in personnel and assembly space.

Large beams are assembled in a spe-

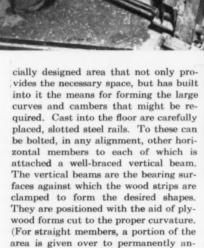


### CLAMPING OPERATIONS

The picture at the top shows the essential steps in forming one of the smaller straight beams. As the laminae come from the glue spreader at the right, they are positioned by the two men standing next to the wall. They are then placed between the jaws of pneumatic clamps and drawn up securely. Following that, Ingersoll-Rand Size 534 Impactools are used to run up nuts on mechanical clamps. This operation begins at the center and progresses to the ends. After all the clamps are taken up, the pneumatic presses are released and the completed laminations are stacked at the left for curing. An Ingersoil-Rand air hoist, equipped with a lifting cradle, transfers the assemblies. The assembly floor for large members is shown in the other two pictures. The one at the left is a close-up of the clamping operation showing one of the Ingersoll-Rand Size 538 Close Quarter Impactools used for this job and a special, extra-length, bolt-clearance socket. The slotted floor rails and the clamping beams can be seen more clearly in the picture above.



Air cylinders power the feed strokes of the end-trimming saw shown in the picture below. There are two saw blades, set at right angles to each other. One trims the end of an arch to dimension, the other squares it off so that it will fit flush with the base of the building of which it will be a part. The assembly is mounted on flanged wheels so that it can be moved back and forth along rails, thus adapting it for other sizes of arches. Another duplicate unit, aligned at right angles to the one shown, simultaneously trims the other end of the arch. Positioning jigs and stops, both on the saw tables and between them, help align and brace the arches during the trimming step. In the other picture (left) is shown one of the traveling band saws that trim larger members. The blade is powered by an electric motor, but the travel of this saw is taken care of by an air motor. This driver, a small Ingersoll-Rand torque wrench, provides much smoother control of the saw's progress than would either hand pushing or an electric motor drive. wheeled unit runs on rails set into the floor



As the adhesive-coated laminae arrive on the assembly floor, they are laid down in order next to their form. When all are in position, in the case of straight members, clamps are tightened to lock up the form. These clamps are much like those used for smaller members, the only essential difference being in size. Ingersoll-Rand Size 538 Close Quarter Impactools are used on this operation. Depending on the size of the member, two may be laid up in the same way as described for the small units, or a single one may be put together, in which case two clamps, one on either side of the assembly, are required, along with a cross bar connecting them.

chored forms.)

The procedure for clamping curved members varies only slightly. After all pieces of the lamination are in position, they are secured to the form at one end.

(The forms are always convex, thus forming the concave surface.) Then a harness is fitted over the other end, and a cable leading to a small winch is attached. The assembly is then pulled into position with the winch which is powered through a 1-inch hex drive by one of the I-R 538 tools. Clamps are then tightened, again beginning at the middle and working out to either end. All of the Impactools are equipped with special bolt-clearance sockets. The clamps themselves pass through the vertical beams and are anchored to them, thus the assemblies are left on the form until the glue has cured.

After the curing period, both large and small laminations are treated in much the same way, the only difference being in the size of the machinery required to perform the finishing steps. The first operation is to surface the beam—plane it to a smooth, even finish For large beams, a machine is installed that can simultaneously plane both sides of a 14x58-inch beam. 103 feet long.

Side-trimming involves rip-sawing material, making continuous cuts of great length and up to 14 inches thick. In early days, portable, rotary power saws were used, but the quality left much to be desired and maintenance costs were high.

To improve quality, Rilco engineers designed a unique arrangement by which traveling band-saws, running on floormounted guide tracks, could make these heavy cuts in one pass. The traveling band-saws were originally pushed through the cut by the operator, but it was practically impossible for the worker to sustain a uniform feed-rate. Thus the finish, after cutting, had a wide variation.

The engineers turned to air power, adapting a Size 22F Ingersoll-Rand air motor to chain drive the wheels of a traveling band saw. Now, operators easily hold uniform saw feed-rates, even though material varies. Ends are then trimmed to specifications.

The final woodworking step is to

hand-patch the lamination wherever required. (This operation has been reduced to a minimum due to the prepatching machine.) Finally, the lamination is finished to specification. There are three qualities of finish commonly used, ranging from industrial, the lowest and that specified for such structures as barns and commercial warehousing facilities, to premium, the finest for use in churches and commercial structures.

The country facility is erected of many of Rilco's own products in the interests of securing large, clear-span work areas in which the massive, custom-built structurals can be handled. The air system in the out-of-town works runs under the floor so that hanging air hoses or pipes don't interfere with the free movement of products. Hose connections to the system are made below the floor line to outlets that can be covered with plates when not in use. Large diameter hoses lead from the outlets and feed short, smaller-diameter sections, or "whips," supplying the tools.

Compressed air is supplied by two Ingersoll-Rand Class ES-1 single-stage compressors, one driven by a 30-hp General Electric motor and the other by a 40-hp G-E unit. The compressors have 9x9-inch cylinders and deliver air at a nominal 100-psi pressure. The 30-hp unit is equipped with constant speed control and loads and unloads at a control pressure of 100 psig. The other unit is equipped with dual control and starts

and stops as required, when air demand is low; or, is switched to constant speed with attendant loading and unloading when the demand is high. Control point for the 40-hp machine is also a nominal 100 psig.

Air hoists are found in many places and, because of their ease of control, are found useful in positioning and handling all members after they are glued up.

Air hoists are particularly valuable in woodworking plants because they are spark and explosion proof, thus reducing fire hazards. In the Rilco plant, ½ and 1-ton units are used in multiples to handle the longer members. The hoists are unharmed by excessive overloading, stalling without harm to the motor. The variable speed of the units permits operators to tighten-up on slings at low speeds, taking the loads slowly for greater safety in lifting, and to gently place the load. This variable speed characteristic helps to prevent damage to the fine finishes and promotes safety.

Air cylinders and expansion hose-type platen clamps are used in many of the gluing machines, not only for clamping but positioning as well. Air cylinders also power the feed and return strokes on some cut-off saws.

Rilco's main offices are in St. Paul, Minn., and warehousing facilities are maintained throughout the country. Its products are in use in most parts of the world, and some installations are pictured on pages 14 and 15. Perhaps one

of the most interesting uses of Rilco products was in the restoration of the famed Stoa of Attalus\*in Athens, Greece. The Stoa formed a protected promenade, enlosing the east side of the Agora, a civic center containing amusement halls, courts, picture galleries and shops and markets. It is 382 feet long. Along its front, 45 Doric columns form the support for a second tier of the same number of Ionic pillars. Behind it, a second row of 22 columns divides the portico and originally marked the openings to 21 shops on each floor of the Agora. The Agora bore an amazing resemblance to modern shopping centers and occupied some 10 acres in the heart of Athens.

The roof timbers of the Stoa ranged in section from 16x19 inches to 18x27 inches. They probably were made of In restoring the old edifice, Rilco-manufactured timbers of gluedlaminated Douglas fir were used. The laminae were 21/4 inches thick and were made up into box girder sections for lightness. The Stoa was built in 159 B. C. by Attalus, a king of Asia Minor, who had studied in Athens and wished to indicate his gratitude to the city. Barbarian invaders destroyed it in 267 A. D. It was not until the American School of Classical Studies began to excavate some 25 years ago that the beauty of the Stoa was again realized.

An example of the versatility of laminated members is the new indoor pool and health club now under construction at the famous Grossinger's Country Club, Grossinger, N.Y. The largest beams used in the structure are 90 feet long, 58½ inches deep and 14½ inches wide. Each weighs 9 tons. Other laminated members in the same building vary from columns, mullions and muntins. In all, approximately 230,650 board feet of laminated wood is to be used.

Bridges are one of the fastest growing uses of laminated structurals. Beams and bridge stringers thus made are dimensionally stable, making them much better for the service than their naturally grown counterparts, and opening the way for wood again to be applied to jobs where once it had been replaced by steel or concrete.

New adhesives, too, may make their mark on the lamination industry. Increased use of the built-up structurals will lead to more familiarity with them on the part of design engineers, it is said, and the current interest of many architects in naturally finished woods may well lead to heavy future demands. Standards for testing not only the timbers themselves, but the glues and woods that go into them, are already in existence. There is some speculation that plastic or other types of overlay will also lead to expanded markets.



AIR SUPPLY

One of the two Ingersoll-Rand ES-1, 9x9 inch compressors that furnish air to Rilco's out-of-town plant at Albert Lea, Minn. One of the machines is driven by a 30-hp motor, the other by a 40-hp unit. The former is equipped with constant speed control and the latter with dual control. Nominal control points and discharge pressures of both machines are set at 100 psig and each discharges through I-R pipeline (PL) aftercoolers to separate receivers. The receivers, however, are tied into a common main.

<sup>\*</sup>Some scholars prefer Attalos

### Secluded

### Skaguay

A Small Hydro-Plant Tucked In A Mountain Gorge Still Functions After 50 Years

CAREY HOLBROOK

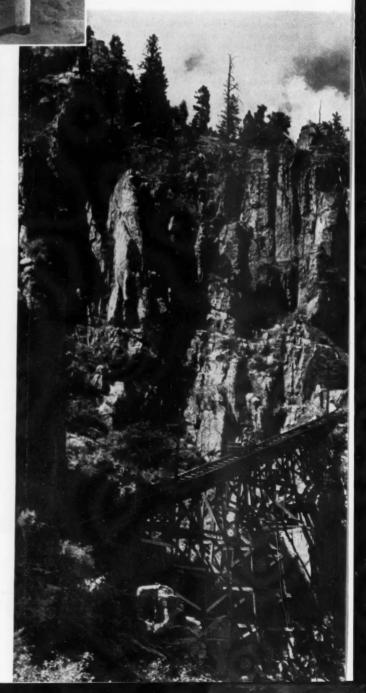


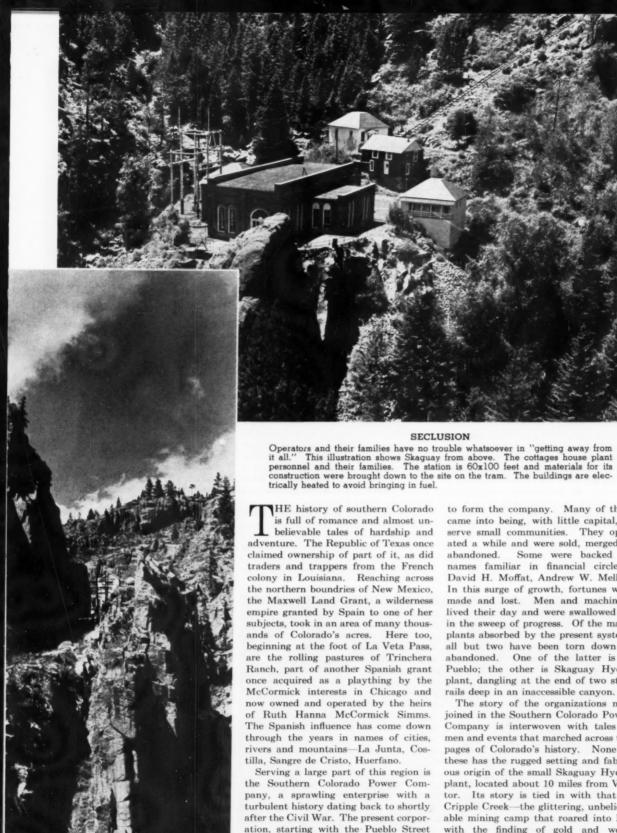
### PENSTOCK

The water to drive the turbines of Skaguay is brought overland by a 30-inch diameter, wood-stave pipe. This plunges over the parapet leading down to the station at the spot shown in this illustration. Just below here, it feeds into a steel penstock that is suspended under the tram tracks. Pressure at the Pelton water wheels below is about 480 psi.

### GOING DOWN

The only way to get to Skaguay, other than clambering for many miles up a rock-strewn stream bed, is via the incline tramway shown in this illustration. It is 3300 feet long and in some spots pitches downward at a 55-degree angle. It also goes through a 185-foot-long tunnel measuring 10x8 feet in cross section.





Railway that was incorporated in 1879,

was built, it might be said, plant by

plant. In the boiling years of its growth

more than 35 organizations were merged

to form the company. Many of them came into being, with little capital, to serve small communities. They operated a while and were sold, merged or Some were backed by names familiar in financial circles-David H. Moffat, Andrew W. Mellon. In this surge of growth, fortunes were made and lost. Men and machinery lived their day and were swallowed up in the sweep of progress. Of the many plants absorbed by the present system, all but two have been torn down or abandoned. One of the latter is at Pueblo; the other is Skaguay Hydro plant, dangling at the end of two steel

The story of the organizations now joined in the Southern Colorado Power Company is interwoven with tales of men and events that marched across the pages of Colorado's history. None of these has the rugged setting and fabulous origin of the small Skaguay Hydro plant, located about 10 miles from Victor. Its story is tied in with that of Cripple Creek-the glittering, unbelievable mining camp that roared into life with the finding of gold and went into a decline when the pay dirt slowly petered out. When Cripple Creek was almost a deserted field, the Skaguay plant in its craggy setting was still going

strong. Now after more than a half century of operation, it still feeds current into the general lines of the company.

The struggle for domination of the electric field was blown into a blaze by the discovery at Cripple Creek. Power plants and railroads sprang up to serve the field. Poles sprouted overnight crowned by thin strands of copper.

Skaguay was the brain child of Warren Woods, who with his two sons, Harry and Frank, arrived in Cripple Creek with the boom. The Woods were real-estate men at the start. In the course of events they promoted the idea of a hotel in Victor, one of the mining camps in the district. In the process of excavating the basement, they struck a rich vein, and the hostelry was abandoned, becoming instead the Gold Coin Mine.

Out of it poured wealth that gave the Woods entry into many fields of business. They opened banks at Victor and Pueblo; and organized Pikes Peak Power Company for the purpose of furnishing power to their mine, and then sold electricity to other users in the district.

They also built Skaguay Hydro plant. It cost more than a million dollars and was completed in 1901. As time rushed on and the yellow dust from the Gold Coin Mine piled up, they conceived the idea of merging Pikes Peak Power Company and Pueblo Traction & Lighting Company with the Woods interests in control. In the process, they pledged all of their assets intending to issue and sell bonds in the new enterprise to take care of the financing; but the bonds were never sold. Rumor has it that the Woods, with their bitter competition, had offended many of the State's bankers to the extent that their projects were



#### POWER ROOM

The original power equipment is still in use at the Skaguay Hydro plant. There are four Pelton water wheels driving four General Electric generators rated at 400 kw each. Current is generated at 600 v, 3-phase and 30 cycle. Not only was all of the equipment brought in over the tram, but it had to be lowered over a 70-foot-high precipice to reach the upper landing stage. The generators and their drivers and accessories weigh about 1400 tons.

either ignored or not recommended when inquiries came from Eastern bankers. When they were unable to sell the bonds, the Skaguay plant, along with the other holdings pledged, reverted to the original owners of the Pueblo Traction & Lighting Company. The Skaguay plant is now owned and operated by Southern Colorado Power Company.

The building of a hydroelectric plant in a spot as rugged and inaccessible as Skaguay was an undertaking that called for much money and men with a mighty urge to build. First was the problem of locating a place where there would be enough drop in elevation between a reservoir and water wheels. This was solved by simply going into a canyon deep enough, and shooting out a flat place big enough, for their purpose.

Next was the problem of how to get materials and heavy machinery into the canyon they had selected. To do this, the builders constructed a tram from near the canyon's rim, right down to the plant site. This tram, still in operation, is 3300 feet from top to bottom. Along the face of the cliff, it makes its way, crossing breath-taking trestles, one of which is 110 feet above the bed of the creek. At one point, where they found a solid granite mountain looking them in the face, they drove a 10x8-foot tunnel straight through for a distance of 185 feet. This carries not only the rails for the tram, but under the track a steel water pipe as well. The entire grade is steep, and the last 700-foot portion pitches down on a 55-degree angle. The tram car is operated by a regular electric mine hoist set at the top of the incline. It is controlled by the operator in the plant below and has automatic safety features that set the brakes in case anything goes wrong.

Four generators and water wheels weighing more than 1400 tons were taken to the plant site over this tram. Materials to build the 60x100-foot brick

### WOOD-STAVE LINE

This illustration, taken about 1900, shows the wood-stave line when it was new. Many sections of the 30-inch facility are still in use. In its 4- to 5-mile course, it crosses seven bridges and goes through a 1500-foot tunnel.



COMPRESSED AIR MAGAZINE

plant building, and three cottages came in the same way. In order to reach the tram for loading, heavy equipment was first lowered over a perpendicular cliff some 70 feet high. The hydraulic equipment consists of four Pelton water wheels complete with accessories, and four 400-kw, 30-cycle, 600-v General Electric generators.

From Victor, a 10-mile-long rough mountain road that reaches an elevation of 9500 feet leads to the rim of the canyon. From there, a stairway with 76 steps leads down to a landing where the tram car is boarded. Ahead lies 3300 feet of narrow track pitching sharply into a blue canyon, and on it, a tiny car is hung at the end of a slender wire rope.

When looking at the location of the Skaguay Hydro plant perched on a ½-acre plot torn from solid rock, one realizes that construction costs must have been high. In constructing the reservoir, which is fed by the waters of Beaver Creek, heading at the foot of Pikes Peak, the builders were not content to put in a simple concrete dam. Instead, the one they built is faced from end to end with a solid sheet of steel, backed by concrete. It backs up a 1½-mile-long lake that spreads over 115 acres and holds 134,087,000 cubic feet of water.

From the reservoir, a 30-inch woodstave pipeline snakes its way for 4 or 5 miles to the plant. In making the journey it crosses seven bridges, ranging from 50 to 360 feet long and from 10 to 35 feet high. At one point it crawls through a 1500-foot-long, 6x19-foot tunnel driven through solid granite. The line ends at the landing stage of the tram, and the water enters a steel pipeline that carries it to the plant. The thickness of the pipe increases from  $\frac{3}{16}$  inch at the top, to  $\frac{7}{16}$  inch at the point of delivery. Total pressure at the turbines is 480 psi, or a 1100-foot head.

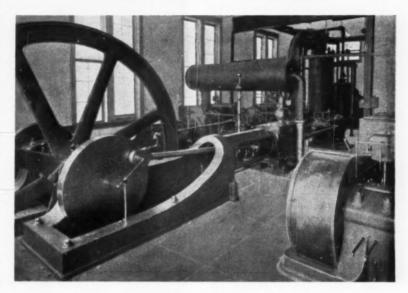
Two families live at Skaguay on the 1/4-acre spot that has been blasted out of the mountain side. This is the entire working force necessary to operate the plant. Every pound of supplies comes to them over the narrow tram. Every visitor comes-and goes-the same way. When deep snow fills the canyon, the residents are held captive until it can thaw-once, from December 16 until the following March 20. One employee is on record as having spent 18 months at the plant without going out on top. Around the cottages there are flowers, grass and shrubs. It is hard to believe that all the soil necessary to support their growth was brought from above. Looking down on this green spot from the heights, it looks like a deserted place. No wisp of smoke rises from the cottages, for there are no fires in Skaguay. Heating, cooking, refrigeration, pumpingall is done by electricity. One hears no

sound of whirring wheels from the depths beneath. There is no sign of activity except for a small tram crawling along tiny rails. Yet, this small plant has a record of steady, dependable operation.

From its secluded site, a stream of power has issued for more than 50 years, broken only during dry spells when the flow of water has been too small to turn its wheels.

This Power Plant Had-

### AIR FOR SALE



EARLY COMPRESSOR

The machine shown here was installed at the La Bella Mill Water & Power Company station and for a time served nearby mines and communities with compressed air. The steam engine portion was built by the E. P. Allis Company, the compressor end, by Ingersoll-Sergeant.

NE OF THE other plants in the Colorado power boom at the turn of the century had the fancy name of La Bella Mill Water & Power Company. It was organized by David H. Moffat and his associates. In addition to thermoelectric power, this plant was designed to furnish compressed air and water to mines and communities in the Its opening, in 1899, was district heralded in a booklet describing the plant and its machinery. The literature said this about the air compressor: "it has a capacity of fifty drills, and supplies air to twenty mines in the district through about ten miles of underground pipes. The compressor is driven by a compound condensing Corliss engine, manufactured by the E. P. Allis Company of Milwaukee. The air cylinders are compound, with an intercooler between the cylinders. The cylinders and intercooler were manufactured by the Ingersoll-Sergeant Company of New York. The air is carried from the compressor to a large receiver where all moisture is separated, and from there it is distributed to the air mains. The

air pressure carried is 100 pounds per square inch."

It didn't take the operators of the La Bella plant long to find out that the scheme of furnishing air to the scattered customers was a losing venture. Because of the altitude and the long hard winters, air meters froze. Thus it was impossible to measure and collect for the air supplied. At a later date, it was decided to adopt a flat rate charge, that is, so much per rock drill. Some of their customers figured that it would be simple to ventilate their mines by just opening an air cock in the workings. This played havoc with the air supply to other mines. Eventually the compressed air service was discontinued.

As for the La Bella Mill Water & Power Company, it found that fuel transportation costs to its high altitude plant were prohibitive, so the central station, too, was shut down. It was absorbed into the system that later became Sourthern Colorado Power Company. For many years, the facility stood idle. Finally, in 1920, La Bella was torn down.

Air power and pneumatic tools played an important role in the carving of America's-

### HERITAGE IN STONE

S. M. Parkhill

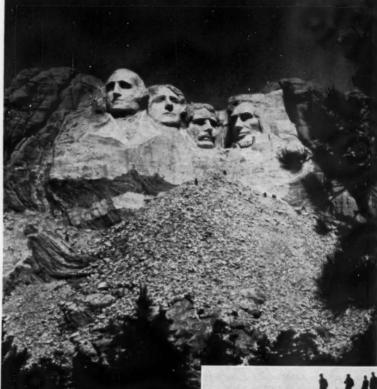
ILLIONS of out-of-state visitors gaze upon the faces of George Washington, Thomas Jefferson, Abraham Lincoln and Theodore Roosevelt each year at the Mount Rushmore National Memorial. "Completed" at a cost of about \$990,000, it includes about 1280 acres of land situated about 25 miles south of Rapid City, S. D., in the Black Hills. Recently the National Park Service, the Mount Rushmore Memorial Society and the South Dakota Department of Highways coöperated in

### Motives of the Sculptor

The words of Gutzon Borglum help us to better understand the Mount Rushmore Memorial, and for that reason, they are quoted here:

A monument's dimensions should be determined by the importance to civilization of the events commemorated. We are not here trying to carve an epic, portray a moonlight scene, or write a sonnet; neither are we dealing with mystery or tragedy, but rather the constructive and dramatic crises in our amazing history. We believe the dimensions of national heartbeats are greater than village impulses, greater than city demands, greater than state dreams or ambitions. Therefore, we believe a nation's memorial should, like Washington, Jefferson, Lincoln, and Roosevelt, have a serenity, a nobility, a power that reflects the gods who inspired them and suggests the gods they have

Too little of civilization lasts into tomorrow and tomorrow is strangely the enemy of today. Each succeeding civilization forgets its predecessor, and out of its body builds its homes, its temples. I want, somewhere in America, so far removed from succeeding, selfish, coveting civilizations, a few feet of stone that bears witness, carries the likenesses, the dates, a word or two of the great things we accomplished as a nation, placed so high it won't pay to pull it down for lesser purposes. Hence, let us place there, carved high, as close to heaven as we can, the words of our leaders, their faces, to show posterity what manner of men they were. Then breathe a prayer that these records will endure until the wind and rain above shall wear them away.



PHOTO, S. D. HIGHWAY COMMISSION

### UNFINISHED MEMORIAL

Mount Rushmore National Memorial as it looks today. It was originally planned to include a carved tablet, in the form of the area that made up the Louisiana Purchase, with outstanding dates and a 500-word history written by former President Coolidge, as well as the busts completed to the waist. The idea for the tablet was abandoned in the early stages. The untimely death of Gutzon Borglum, the sculptor, and the entrance of the United States into World War II, brought the 14-year construction period to a halt. Note the rubbled base that makes it nearly impossible to climb to the figures, even if it were permitted by the National Park Service. To better understand the size of the work, the face of Washington (far left) is 60 feet from his chin to his wigline. His nose is 20 feet long and his mouth measures nearly 19 feet in width. Lincoln's eyes (far right) measure 6 feet between the lids and are the largest of the four figures. If completed, they would stand 465 feet, overall. The mountain itself is 5725 feet above sea level. Visitors gaze up from a level about 500 feet below



building new approaches, parking lots and better facilities there, thus making it one of the most modern of the areas served by the National Park Service.

The idea of the memorial was originally that of Dr. Doane Robinson, State Historian of South Dakota. In the years immediately following 1923, lengthy discussions were held with state and national governmental officials, and it was decided to call the famous Americanborn sculptor Gutzon Borglum to look over various proposed sites. After a considerable search for a suitable location, a large biotite-muscovite granite outcrop known as Mount Rushmore was selected. It best met the requirements in that the stone receives full sunlight during most of the day, and it was available in sufficiently large masses, free from fracture, as to be applicable to group sculpture. The lower slopes are pine covered; above them, the rock extends almost perpendicularly. Today, the base is rubble coated and attempting to climb it is not only forbidden, but is nearly impossible. Hence the faces are free to gradually change from their original white to a pleasant grey tone without scars of vandals.

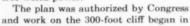
### COMPLETED FACES

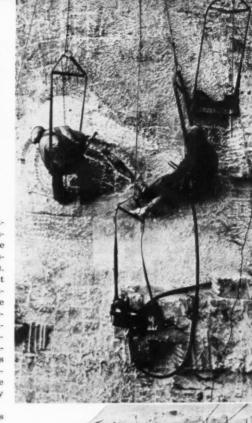
At the left can be seen the profile of George Washington, and in the right foreground, that of Thomas Jefferson. Although originally scheduled to be in reverse positions and to have been constructed in reverse order, plans were altered because of the fissures in the granite, and Washington took shape first. At the top of his wig can be seen one of the crude shacks that was used for housing measuring devices.

#### SAFETY HARNESSES

Devised by the sculptor, safety slings were used throughout the construction. A close-up view of empty ones can be seen at the right; the other photograph shows them in operation. Each harness was suspended on a wire cable from a winch in a shed on top of the cliff and bore a number. When a workman wanted to move up or down, he called out his number and the direction in which he wanted to move to a "call boy," in a cage on the left side of Washington, who relayed signals by telephone to the winch houses. The winch controlling his cable was manually operated accordingly.

The actual designing and subject matter of the memorial was left almost entirely to the discretion of Borglum. He chose as subjects four of the more illustrious presidents of the United States. These men, he thought, best represent America and its development. Washington is considered the Father of the Country, Jefferson drafted its basic freedoms and added to its westward expansion through the purchase of the Louisiana Territory. Lincoln is best remembered for his efforts in holding the states together, and it was during the administration of Theodore Roosevelt that the United States became an economically free world power.









the summer of 1927 after the mountain had been dedicated by former President Calvin Coolidge. First executed was the face of Washington, the likeness being dedicated on July 4, 1930. Beside him are the features of Jefferson, represented as a young man of 33 years, for it was at that age that he authored the Declaration of Independence. The late President Franklin D. Roosevelt unveiled Jefferson on August 30, 1936. A year later, the right-most figure, Lincoln, was dedicated; and in 1939, that of Theodore Roosevelt. In actuality, only 61/2 years were required to finish the project. The balance of the time was consumed in financial and inclement weather delays.

Plaster of Paris models were prepared by Borglum in a 1-to-12-inch scale. The rock was then roughed out with air tools and blasting to within 6 inches of the final size. A piece of steel was next mounted on the forehead of each model, and two pieces extended at right angles from its ends, back along the sides of the head. A similar 3-sided structure was constructed on the actual workings. From the former, strings were hung and measured to various features on the face. These distances were multipled by 12 and marked off on the actual carving. In this way, work proceeded nearly to the dimensions of Borglum's model.

For the roughing out work, Ingersoll-

Rand Jackhamer drills were used to bore down holes. The exact number of drills used is not known, however one still remains on display at the museum there. These holes reached a depth of 40 inches and were placed in a row. Using 40-percent gelatin dynamite, electrically fired, slabs 4 feet thick and 30 inches wide were shot off.

For the remaining 10 percent of the work, greater care had to be taken in drilling. No blasting was done, the final 6 inches of material being totally removed by air tools. Closely spaced Jackhamer holes were drilled perpendicular to the surface and to the desired depth. The rock between these was then broken out with plug drills using moilpoint steels. Final smoothing was done with pneumatic tools fitted with small 4-point bits known as "bumpers."

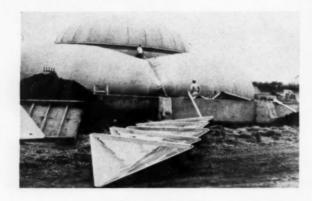
During most of the operation, Borglum was in direct charge of the working crews that numbered between 25 and 40 and included drillers, powdermen, carvers, hoist operators, blacksmiths, tool sharpeners and similar skilled workers. He worked on his models and guided the crews from his studio, about 1550 feet from the mountain side and directly facing them from a lower altitude. This building housed the concession at the park for many years, the models having been moved to a separate museum and administration building constructed by

the National Park Service. A new, modern building was completed in the spring of 1957 for the concession, and future plans for the studio are in the making.

Air for the Jackhamers and other pneumatic tools was furnished by three Ingersoll-Rand compressors, one being a small portable unit; the others, Class ER-1, stationary types, short-belt driven by 100-hp motors. The compressor house was located below the workmen; the air was forced to the top through 4-inch metal pipes. One stationary unit had a piston displacement of 386 cfm, and the other 528 cfm. A blacksmith shop near the compressor station was equipped with an I-R sharpener for reconditioning the drill steel.

After the unexpected death of the sculptor on March 6, 1941, work on the carving slowly came to a halt. His son. Lincoln, finished certain details and supervised the cleaning-up operation during the remainder of that year; however, without the guiding hand of Borglum and since the United States had entered the Second World War, work stopped. The monument stands today. as it will millions of years from nowfor it is estimated by geologists that it will erode at a rate of 1 inch per 100,000 years-unfinished except for the faces. Thus, this Shrine of Democracy" is rightly called "an unfinished symphony in stone."

### BALLOONS RAISE ALUMINUM STRUCTURE IN 22 HOURS



TESTING

This being the first raising of a geodesic dome by air power, testing of the operation was first required. Models were constructed to scale and methods were worked out for guying and controlling the operation. Then the actual balloons to be used were cemented and sewn together. Some 4200 square yards of Du Pont's Hypalon-coated nylon were used.

RECTION of geodesic domes normally is done by using a steel tower with cable and winches to provide the lift. This method requires adequate footings and sufficient span for guying. Recently however, Vacu-Blast Company of Belmont, Calif., wanted to raise a 16,500-square-foot factory in Abilene, Kan., by means of pneumatic bags. They called Industrial Covers, Inc., a San Francisco, Calif., firm to do the job.

A geodesic dome starts with a center section at ground level. Panels are then added to its periphery with gradual or intermittent lift being applied to clear the outer edges for the addition of new panels. The particular one in question is 145 feet in diameter and 49.5 feet high. Its weight is 39,000 pounds, and an additional 60,000 pounds was added for wind load, counter force of tie-downs and other factors. Five hundred seventy-

five sections were put in place, terminating in points setting on piers 3 to 6 feet high. Each aluminum section is diamond shaped and curves inward. Each is braced on the concave side by an aluminum strut. The panels are 1/16 inch thick and are lined on the inside with 36 inch of glass fiber insulation in an atmosphere of Freon gas. In order to retain the gas, a thin plastic film was heat-sealed at each panel edge.







### **ERECTION PROGRESS**

The three illustrations (above) on this page show three moments during the erection of Vacu-Blast Company's 16,500-square-foot factory in Abilene, Kan. At the right, the building is shown starting up as the balloons are inflated. After each increase in bag size, diamond-shaped panels were added. Dome erection progressed at first only on the smaller of the two balloons (top). At the left is the dome

as it looks completed. It was secured on piers before the bags were deflated. It has a height and dicmeter of 49.5 and 145 feet, respectively. Each section of the building is made of aluminum sheet a little more than ¼-inch thick. Each is curved inward and stiffened on the concave side by an aluminum strut. In all, 575 panels were bolted together and attached to 25 piers.

The piers are made of concrete, as is the foundation. It was laid before erection work began, thus permitting the foundation to serve a double purpose: as a working platform for the raising of the dome, and as a floor for the finished factory.

Two bags were used. To avoid excessive pressure against any one area, through one bag bearing more strongly than the other, either through position or differing internal pressures, a special design and inflation schedule were utilized. The upper balloon was 50 feet in diameter and 24 feet high. Its top sector paralleled the arc of the dome and contacted its exact center. The lower sector was more round and nested in a recess in the bottom bag. This balloon was 95 feet in diameter, 33 feet high in the center and 46 feet at the shoulders. The smaller bag was made in two sections, the larger in three. During erection, the former carried the load until the dome had reached a specified diameter at which time the larger one was inflated and the two combined to provide lift

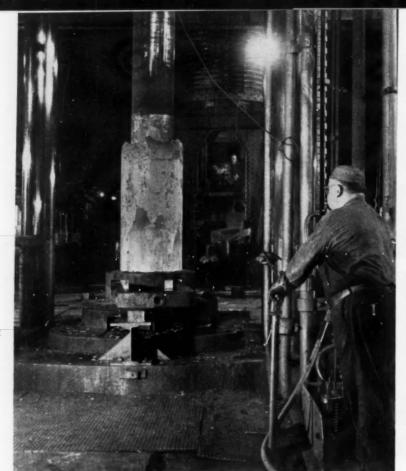
until the project was completed. In all, 22 hours, representing 836 man-hours, were required. Fluorescent lamps, 23 feet above the floor, light the factory. Heat is furnished by a forced warm-air system.

Hypalon-coated nylon was used since the surface had to be tough and dry so that it would not get "hung-up" on protrusions, and because exceptional abrasion resistance was necessary. The components of the bags were assembled at the site. They were designed to operate under pressure of 20 pounds per square foot. During the erection sequence, a manometer indicated 3 inches H2O gauge on the small bag, or 15.5 pounds per square foot, while the larger one showed 7.75 pounds per square foot. Knowing the strength quality of the nylon, it was realized that any cut or break in the balloons would not become larger from internal pressure. It was also possible to calculate blower capacities necessary to offset air loss through openings as long as 6 feet, should they occur. Provisions were made for workmen to enter

the bags during the process so that repairs could be quickly made. Personnel at the scene of the construction reported that when they entered the balloon, the appearance of the surfaces, the geometric arrangement of the cloths and the outline of the small bag sitting in the recess of the large one, was most impressive.

A bank of three centrifugal blowers, each with a capacity of 4450 cfm at 4 inches H<sub>2</sub>O gauge were used for the air supply. One fed air to the smaller bag through an 18-inch duct and was equipped with a vertical sliding gate to adjust the volume. The others were coupled to a wye with separate gates on each leg so that air from either or both could be supplied through a 26-inch duct to the larger balloon.

After exploring and finding feasible this new concept of building erection, Industrial Covers, Inc., expects that it may be applied to many other types of construction in the near future. As an example, large steel gas tanks could be assembled with all welding done at the ground level.



### WHITE-HOT BILLET

Pierced into a hollow forging under great pressure, a white-hot billet goes through the first step of becoming a cylinder. Heated to 2400°F, the billets are pierced to form rough cylinders for further drawing into desired length, diameter and wall thickness. Finished cylinders, depending on final use, may vary in length from 3 to 80 feet and be up to 30 inches in diameter.

### GIANT "BLIMP"

Looking like a blimp, but in reality one of thirty 80-foot oxygen cylinders made at U. S. Steel Corporation's National Tube Division, these cylinders will serve as part of a high-pressure oxygen storage plant at Granite City, Ill. Some cylinders are produced with 3-inch wall thicknesses to contain pressures as high as 10,000 psi.

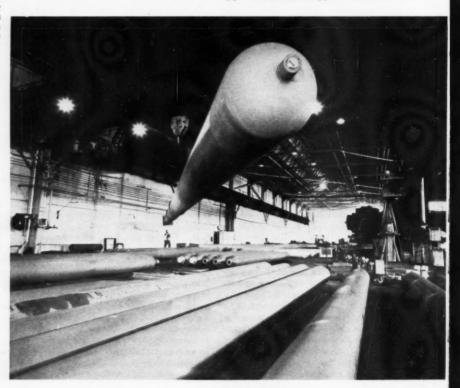
### PRESSURE-MANUFACTUR

MODERN day requirements for gas cylinders call for containers up to 80 feet in length and capable of holding pressures as great as 10,000 psi or higher. Only a few years ago, the top pressure, except in unusual circumstances, was but 2200 psi, and dimensions were much less as well. Wall thicknesses, for example, rarely exceeded ½ inch, yet today 3-inch walls are fairly common.

Not only are well-known gases being used and stored under higher pressures than before, but new gases and combinations of gases are being developed. To meet these requirements, and others of a special nature, heavy-walled containers of high alloy steels, varying from 3 to 80 feet in length and with diameters as large as 30 inches, have been developed by U. S. Steel Corporation's National Tube Division.

They are manufactured from white hot billets that are pierced into a hollow forging under great pressure to form the rough cylinders. They are then drawn into the desired sizes and machined. The ends of the cylinders are hot formed either by spinning, swaging or forging.

Interior cleanliness is important. Other critical specifications include the type of steel used, application of norm-



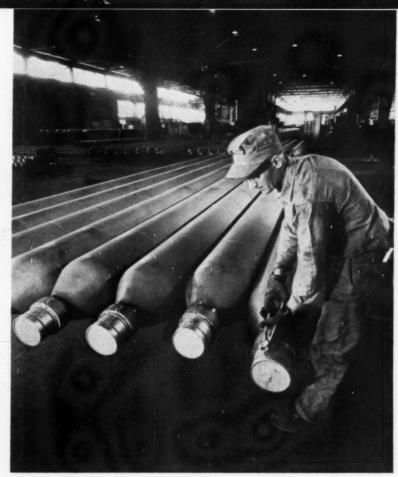
28

# CYLINDER ING CHANGES

alizing or special heat-treating and hydrostatic testing of the finished cylinder. The end product must not only meet customer and Defense Department specifications, but the rigid specifications set forth by the American Society of Mechanical Engineers as well.

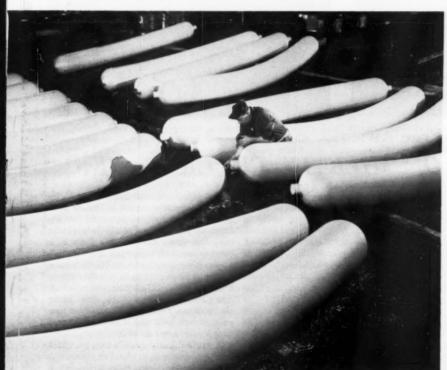
In recent years, cylinders have been made for the government's guided missile program to hold hydrogen, helium and nitrogen under extremely high pressures to back up the propellant for launching vehicles. Cylinders are made for the oil refining industry where hydrogen is used to make high octane gasoline for today's automobiles. The use of hydraulics to operate heavy machinery in the country's mills and factorieshas also placed an increasing demand on the producers. Hydraulic cylinders must be made to accelerate machinery at pressures of 25,000 psi or more, as in the case of giant extrusion presses that turn out airplane parts.

Welding in industry with helium and argon gases has become more prominent in recent years resulting in a demand for high-pressure containers to handle them. In all cases, the vessels must be made to withstand rigid tests before they can be used.



#### PROTECTION

Threaded protectors are installed on giant cylinders by a workman. Thirty cylinders of this type make up the series used in a railroad tank car for transporting helium. Cylinders produced at the McKeesport, Pa., works must withstand tests to make sure that they are substantial enough to be transported over highways and railroads.



### "HOT DOGS"

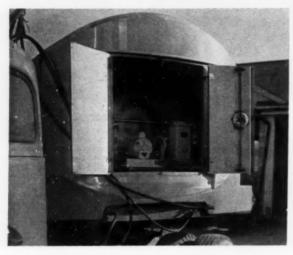
What appears to be a huge hot dog griddle in reality shows curved cylinders made at National Tube's Christy Park Works in McKeesport, Pa. The gigantic "frankfurters" are 15-foot cylinders that will be placed in a submarine to store oxygen under pressure. They are being painted prior to shipment. To help utilize every cubic inch of space, these cylinders were curved to conform to the vessel's hull contour.

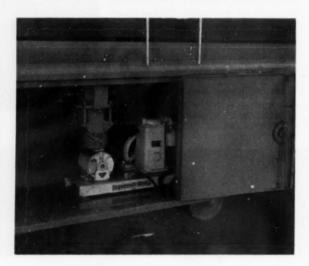


#### TRUCK-MOUNTED COMPRESSORS

Collection trucks owned by Greenwood Dairies (above) carry their own air systems. Each is equipped with an Ingersoll-Rand Model NX5, air-cooled NL compressor. One vehicle mounts the unit directly behind the cab (below, left); the other, in a compartment beneath the tank (right). Both are driven by ½ pp G-E motors. Although the

tanks are of 2500- and 2800-gallon capacities, the milk is agitated more rapidly than with mechanical apparatus and can be continuously mixed until the level of milk is within 4 inches of the bottom. With mechanical agitation, this was not possible; the moment the milk fell below the upper most level of the paddle, air was whipped into it.





### **Another Use For Oil-Free Air:**

### AGITATION OF MILK IN TRUCK TANKS

THROUGHOUT the United States, more and more dairies are discovering that methods of agitating milk with oil-free air in holding tanks can be applied directly to their truck tanks. This not only prevents cream and milk from separating while the liquid is standing, but in many cases also saves time and money by eliminating the necessity of moving the milk to holding tanks for agitation before pasteurization.

The equipment used is relatively the same as that used in holding tanks: a nonlubricated compressor mounted either directly on the truck or located at the dairy to supply the air, a filter and

lengths of sanitary pipe either installed within the tank or available at the dairy to be plunged into the tank when it arrives from the route. In the former installation, the milk can be agitated periodically during collection, while in the latter, the truck has simply to back into the dairy for the agitation process. Both are proving their value in time and money saved.

An installation of the first type is that of Greenwood Dairies, Langhorne, Pa. Two trucks of 2500- and 2800-gallon capacities are used. Each is equipped with an Ingersoll-Rand Model NX5, vertical, single-acting, single-stage air-

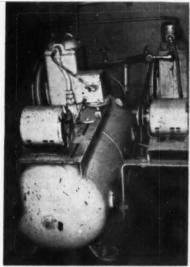
cooled NL compressor driven by a ½-hp General Electric motor. The smaller truck has its system mounted at the front of the tank, directly behind the cab; the other, beneath the tank in a compartment. Inside, each is fitted with 1½-inch sanitary pipe with 3/32-inch holes drilled on 3-inch centers in a 30-degreeangle pattern. By using the method, not only can agitation be done along the pick-up route, but it has become practical to hold the milk in the truck tanks overnight, as well.

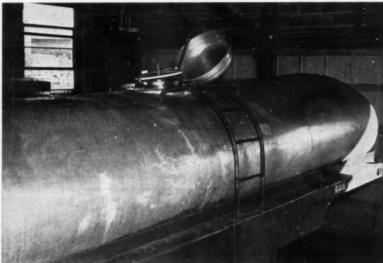
A typical dairy installation in which the compressor is at the dairy proper is that at Dairy Coop Association, Port-

#### DAIRY-INSTALLED COMPRESSORS

These three illustrations show typical installations where milk is agitated in tanks at the dairy. At the right, an Ingersoll-Rand Model N compressor is mounted on the wall (upper right) at Dairy Coop Association. Air is fed from it through a stainless tube header from which four \$\frac{5}{16}\cdot{inch} air hoses drop. To these are attached 1-inch, open-end pipes that are placed in the various compartments of the truck tank. Agitation is completed in a matter of minutes, and the milk is ready to be moved to pasteurization equipment. The other photographs were taken at Cream-O-Land Dairy, New Brunswick, N.J. The truck backs into the building, and a length of sanitary pipe is inserted into it (below, right). Air is supplied for the operation by an Ingersoll-Rand 235-HNLC3 compressor (below).







land, Ore. An Ingersoll-Rand Model N compressor is mounted on the wall there. Air feeds from it through 15 feet of 1/2inch plastic hose to a stainless tube header from which four 5/16-inch air hoses drop. These are attached to 1-inch pipes, 6 to 7 feet in length. They are not perforated, as in the former example, but are merely open on the end. The pipe is inserted through the tank's top opening into each of its compartments, and the free flow of air thoroughly mixes and agitates the milk in a matter of minutes. The tank's contents are then pumped directly into pasteurizing equipment, thus eliminating the necessity of pumping the milk into agitation tanks before moving it for pasteurization.

Cass-Clay Creameries, Inc., Fargo, N. D., utilizes a system that is somewhat of a combination of the two, that is, the I-R NX5 compressor is mounted on the trailer portion of each truck. From it, a plastic hose is connected to an openend pipe. Four-thousand-gallon truck

tanks can be agitated in 5 minutes so that all samples are the same. After transporting the milk hundreds of miles to its customers, some being in Arkansa and Montana, the milk is still well mixed. Current is supplied by means of an extension cord attached to the motor.

Although the principles of air agitation have been used successfully in other industries, it was felt for a long time that by applying it to the dairy field, the milk would be changed. Thorough examination and testing have conclusively shown that the quality of the milk, the flavor, vitamin content and the like are not changed. Further, because nonlubricated compressors are used, there is no chance of oil mixing with the milk.



#### RUNWAY-MOUNTED COMPRESSOR

The truck in the illustration at the left is a 4000-gallon vehicle belonging to a fleet operated by Cass-Clay Creameries, Inc. It mounts an Ingersoll-Rand NX5 compressor from which a plastic hose connects to an open-end pipe which is placed down through the dome on the truck for agitation. Reportedly, a tankful of milk can be completely agitated in 5 minutes. Since many hundreds of miles must be traveled between pick-ups and deliveries, the milk and cream, if not agitated, would separate. However, now it can be kept mixed along the way, and the samples remain consistant.

### This and That

The use of industrial tele-TV's Eves vision as a means of aid-To Serve ing timber sorting may Lumbering find use in Sweden. Under the scheme being planned, logs floating to a sorting station

would be separated by hoisting each from the water and scanning its sawed end with a TV camera for the proprietary marks of the lumber cutter. The view would be relayed to the operator of the hoist, thus enabling him to set the log down in the proper place for bundling and shipment.

Volcanic-Steam Station

Early this summer New Zealand will have the world's first big thermalelectric power plant driven by volcanic steam.

It will turn out 69,000 kw. Government owned, the plant will cost an estimated \$16.8 million. Steam to drive the turbines will come from the Lake Taupo area of North Island, one of the world's few geothermal regions. There, as in Yellowstone Park, underground water comes in contact with hot subterranean rocks producing geysers, steam jets, etc. The steam table can be tapped, it is said, throughout an area of more than 3000 square miles, much of it close to big cities. One small test-bore has

produced a total of 130,000 pounds per hour of water and steam. The plant initially will use dry superheated steam from high-pressure bores, although later it is hoped that means will be found to use wet steam and hot water. If that is possible, output may rise to 250,000 kw.

lightweight turbinedriven fan designed to pro-Cooling Jet vide Boeing's 707 jet airwith comfortable Aircraft liner cabin temperature while

the craft is on the ground has been developed by The Garrett Corporation. In flight, ram air obtained by the swift speed of the plane is channeled through heat exchangers to reduce the high temperature of pressurized air heading into the cabin. However, while on the ground, taxiing or at relatively slow air speeds, such air is absent or is supplied insufficiently. In these situations, the fan unit takes over, playing a supplementary role in the pressurization and air conditioning systems. It is said to be the first of its kind in commercial aircraft application.

The turbofan has a ring that circles the tips of the fan blades and has turbine buckets mounted on it. Air ducted from a turbocompressor is forced against the buckets, turning the unit at speeds ex-

ceeding 11,000 rpm. By this action, the ambient air is drawn through heat exchangers to cool pressurized cabin air that is being cross-channeled through these same exchangers. After performing its cooling task, the air drawn by the fan is exhausted back to the atmosphere. An automatic switch is regulated to turn the unit on when the 707 is on the ground, while another, operative in flight, starts it in the event that the temperature in the cooling units, under certain conditions, rises too high for lack of ram air.

Natural Rubber

Production of Natsyn, a Synthetic new type of synthetic rubber that has the same molecular structure and performance characteris-

tics as the tree-grown product, is now underway at a large Goodyear Tire & Rubber Company pilot plant. The new facility moves experimental work out of the laboratory, and because of its capacity will enable the manufacture of enough of the product for extensive tests. The pilot plant was built at a cost of about three quarters of a million Goodyear expects that the facility will lead to a full-scale production plant of 25,000 to 30,000 tons-peryear capacity. The first Natsyn was made in the laboratory in 1955 and depends for success on the availability of isoprene. This chemical derivative is now in short supply, only one commercial maker being in this country. Processes for making a low-cost, high-purity isoprene are well into the developmental stage, however. Natsyn is made from the same basic isoprene molecule as is the natural variety. It is undistinguishable from the natural substance and behaves exactly the same way. Further, it is treated in the same way once it is made although manufacture takes but a few hours rather than the years needed for nature to do the trick.



### PNEUMATIC BATTERIES

The Army's Redstone Missile, this country's first medium range missile in full production, makes use of high-pressure air to operate various of its robot mechanisms. The tanks that store the air are spherical in shape and are shown in this picture getting a final check before installation. Some tail sections for the weapon are shown in the background, and the sign on the post at the right indicates that pressures as high as 3000 psi are not uncommon in missile work. The Redstone is 63 feet long and can carry a nuclear warhead some 200 miles with accuracy. It is now in the hands of our troops.

Watertight Secretariat Building

The exterior marble walls of the 39-story Secretariat Building at the United Nations are being waterproofed by

Brisk Waterproofing Company, Inc. The north and south sides of the structure are 500 feet high and 72 feet wide; there are no windows or other apertures in them. They do include, however, about 10,000 pieces of Vermont Marble of varying sizes. All mortar from the joints between the pieces is first removed. Then a compound known as Del, a synthetic rubber caulking compound, is inserted. When completed, workmen will have covered about 13 miles of such joints. Special rigging had to be planned in order to reach all areas of the walls and all heights. It consists of scaffolding that is shaped around the corners of the building, thus enabling the workmen to obtain access to the working platforms through windows in the east and west walls.

Crop damage caused by birds Bangs and wild game is one of the Chase serious problems faced by Birds farmers. To help combat it, several companies have developed automatic exploders that operate around-the-clock to scare birds and other wild game within a large radius. Most use acetylene, some making it with carbide. Operation is quite simple. The exploder unit has within the combustion chamber a small glow plug heated by current from a battery. A control valve admits compressed gas in minute quantities from a tank. When the concentration of gas in the chamber reaches the ignition point, an explosion occurs. Afterwards, fresh air flows into the chamber, and more gas bleeds in from the tank. Regulating the control valve on the gas holder thus determines the frequency of the bursts.

Civilian Atomic Reactor It was announced in December of last year that the world's first full-scale nuclear power plant, exclusively for civilian use,

was operating at full power. The plant delivered, on a test basis, 60,000 kw of electricity net to Duquesne Light Company's Pittsburgh, Pa., system. The turbine-generator produced 68,000 kw, the difference of kilowatts being required for the station's three reactor circulating pumps, lighting and miscellaneous purposes. Westinghouse Electric Corporation built the unit, and the Duquesne facilty contributed \$5,000,000 toward the reactor portion of the plant.

Man-made winds and rains, driven at hurricane speeds as great as 120 mph, are determining the weathertightness of new aluminum curtain wall designs. Although they may never be subjected to such punishment in reality, it is said that the drastic test insures an extra margin of safety. The cyclones in miniature are generated in a huge wind tunnel at

Moynahan Bronze Company's facilities

in Flat Rock, Mich. An average produc-

tion wall, 25 feet wide and 15 feet high,



PHOTO, THE CANADIAN MINING AND METALLURGICAL BULLETIN

#### PRE-COMPRESSED-AIR DRILL

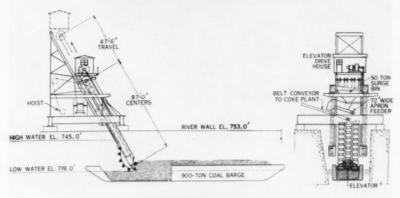
The odd-looking device portrayed above is a rock drill. More specifically it is a hammer for driving drill steel. Supported on a column mounting, the machine presumably worked by pulling back the swinging hammer and letting it fall, thus striking the steel. The hammer weighed about 50 pounds. The photograph originally appeared on the August 1957 cover of the "Canadian Mining and Metallurgical Bulletin" and was supplied by Dr. A. C. Skerl, Consulting Mining Geologist, Vancouver, B.C. The ingenious device was discovered in the course of examining some old mining properties in the St. Mary River area, East Kootenay, B.C. A tunnel had been driven to the right of the waterfall in the background. The hammer is held upright for the picture by the body of an old mine car. A well-known Canadian prospector, Mr. E. Lawrence, appears in the photograph.

is assembled in an ordinary manner and placed behind the air tunnel. Then a powerful, propeller-type aircraft engine hurls water and air against the test panel. The facility is so constructed that an inspector can stand behind the wall, protected from the wind and rain blast, to minutely inspect all glass and aluminum joints during the test.

Experiments that was confiscated Within A from a smuggler by the Diamond United States Bureau of Customs has been turned over to the National Bureau of Standards where it is serving as one of many pressure chambers in a basic research program in which the extraordin-

ary heat and pressure of atomic explosions are simulated. The gem was originally cut in emerald shape, but for experimental purposes, it was flattened on two sides and the bottom. A hole, 0.015 inch in diameter, was drilled length-wise through the diamond. Two tiny pistons of hard tool steel that closely fit the opening are inserted, one from each end, with a sample of the material that is to be investigated between them. The diamond is then placed in a hydraulic press and surrounded by an induction heating coil. Because of the tiny dimensions of the pressure cell, it is necessary to apply a weight of only about 80 pounds to bring the internal pressure to 450,000 psi. Pressure greater than that might split the stone. Through the sides of the chamber, changes are scanned under infra-red rays.

### BIG SCOOP



### SIDE AND END VIEWS

The drawings above show the coal barge unloader at work on the Monongahela River, southeast of Pittsburgh, Pa. At the left is a side view of the monster in operation. A hoisting mechanism raises and lowers the bucket lines so that the unit can continue operation no matter how high or low the river flows. The end view, (right) shows the means by which the lifted coal is transported by conveyor to the steel company where it feeds the 1567 ovens of the 23 coke batteries. The structures at the base represent the river wall and pier; the loaded vessel is pulled between these while Big Scoop goes to work.

DIG Scoop is the name of what is said to be the world's fastest barge unloader. It feeds 23 coke batteries—1567 ovens—in the chemicals operation at U.S. Steel's Clairton Works on the Monongahela River, southeast of Pittsburgh, Pa.

Emptying a 900-ton river coal barge in less than half an hour, the monster is push-button operated and replaces two clamshell bucket hoists. It was designed, fabricated and erected by Link-Belt Company and consists of three endless lines of bathtub-size buckets, each of 1/2-ton capacity. In operation, a boom over which the buckets travel, is lowered to a loaded barge. As the boat is pulled slowly between the river wall and the piers that support the scoop, rotating buckets eat their way through the coal, stripping it out in barge-wide layers. Two passes empty a vessel, and the coal is raised to conveyors. From there, it is sent to the steel company's various operations, including the manufacture of metallurgical coke, coke oven gas and a variety of coal chemicals.

### First Pyrene Fire Extinquisher

COME 50 years ago, ingenuity, enter-Oprise and a can of sewing machine oil helped the Pyrene Company of Newark, N. J., establish the modern fire-protection industry in America. A Scotsman named Peter G. MacGregor was employed by a tool company on New York City's Center Street. Mac-Gregor had only one arm, but in spite of his handicap, had so effectively learned to utilize a knee and foot in place of the missing member, that he was an expert mechanic. He conceived the idea of developing a portable fire extinguisher that would be superior to any on the market at that time. Consequently, he set to work in his home workshop to devise a suitable pump and container.

A fellow worker, E. M. Davidson, who had a knowledge of chemistry, suggested that MacGregor use a vaporizing liquid chemical in his new device, rather than water, the only substance then in use. Davidson pointed out that this chemical would be ideal for electrical fires.

The first extinguisher MacGregor turned out was a crude, but effective, device consisting of a tin cylinder and a simple piston pump. A born improviser, MacGregor pressed a workshop chisel into service as a pump handle; and, when his wife's back was turned, he surreptitiously removed the spout from her sewing machine oil can to use as a nozzle. Out of this combination of skill, enterprise and domestic skulduggery came the first portable chemical fire extinguisher in America.

As simple as the device was, it did an effective job. When squirted on a fire,

the chemical vaporized, displaced the oxygen in the air and put out the blaze. Whereas a bucket of water dumped on an electrical fire almost guaranteed the electrocution of the unlucky wielder, the vaporizing liquid in MacGregor's contraption was a nonconductor. Furthermore, the liquid did not freeze or corrode its container, as did water.

The two inventors decided to leave the tool business, in 1907, to form their own company—a 2-room shop in New York. They assumed the name Pyrene, a derivitive from the Greek work pyros, meaning fire. The first chemical extinguishers sold for \$5.00 but, unlike modern models, could not be refilled. The partners reasoned that it was worth this price if a single fire was quelled.

The New York company operated on a small scale for the next 2 years. In 1909, the predecessor of today's Pyrene company was incorporated in Delaware. Davidson eventually sold his interest, but MacGregor continued with the company as a designer and consultant until his retirement in 1941 at the age of 71.

In the years that followed its incorporation, Pyrene grew apace with the fireprotection industry it helped create. On its twenty-fifth anniversary the company could state without exaggeration that it was supplying the world with "approved protection for every fire hazard." This included the vintage automobiles of those early days that now and again developed the distressing habit of bursting into flames.

From modest beginnings, Pyrene steadily expanded its position of leader-

ship in the industry. In 1933, it affiliated with the C-O-Two Division of the Fyr-Fyter Company, Dayton, Ohio.

Today, Pyrene is America's largest manufacturer of fire protection equipment, including safety-engineered vaporizing liquid, soda and acid, foam, carbon dioxide and dry chemical portable extinguishers, as well as a complete line of high- and low-pressure carbon dioxide and foam systems.



### COMPRESSED AIR SUPPORTS THE WORLD

Revolving on a 2-way stand, the world pictured here is held in shape by compressed air. Eighteen inches in diameter, it is comparable to a 56-inch wall map. Because of its shape, all data listings are clear and easy to read. When it becomes dirty, it is a simple matter to deflate the unit and wash its vinylite face.

### EDITORIAL

### Catalysis

A MONG the many chemical reactions that we depend on today for a wide variety of our needs, a great many depend in turn on catalysis or the chain of events accompanying catalytic action. Webster defines catalysis as the acceleration of a reaction produced by a substance (called the catalyst) which may be recovered practically unchanged at the end of the reaction. The definition goes on to point out that the action can be either positive or negative, that is, it can greatly advance the speed of the reaction or retard it.

Perhaps the best known example of catalvsis is the catalytic cracking or refining of petroleum. The techniques evolved therewith are chiefly responsible for the high-compression engines that we know today, for they make economically possible the production of high-octane motor fuels. It was in 1913 that A. M. McAfee developed a method by which anhydrous aluminum chloride could be used as a catalyst for cracking. Little of practical importance came from that discovery, but another one, in the 1920s, by E. J. Houdry, in France, did reach commercial importance; in 1936 the Socony-Vacuum Oil Company (now Socony-Mobil) erected the first commercial Houdry-process catalytic cracking plant in this country at Paulsboro, N. J. Some 26 of these plants were in operation by 1943. Soon thereafter, a revolutionary new process hit the field with the development of fluid catalytic cracking. Standard Oil Development Company, Standard Oil Company of Indiana, The Texas Company, Universal Oil Products Company, The M. W. Kellogg Company and Shell Development Company all had a part in the successful commercial development of the process. The catalyst used was a silica-alumina compound.

COMPRESSED air came to the fore with the development of the fluid process. It was used not only for fluidizing, but for aiding in the regeneration of the coke-covered catalyst particles as well.

The petroleum industry has always been in a great state of flux as far as processes go, and it was not long after the war that Universal Oil Products Company, among others, began to utilize the catalytic effects of platinum, finally resulting in the process known as Platforming. In a way, catalysis had come a full circle, for it was with a platinum catalyst that the first significant scientific approach to the phenomenon was made.

MICHAEL Faraday was performing one of his famed experiments with electricity when he observed that hydrogen and oxygen produced by electrolysis sometimes combined quite forcibly to form water; at other times ap-

parently did not combine at all; and when left in the presence of clean platinum electrodes, combined steadily but without explosive force. He came thereby to the remarkable conclusion that the metal had the power to occlude (today we call it adsorb or chemisorb) gases and cause them to react.

Later, Langmuir showed that the forces at work fitted certain laws of chemical reaction which he formulated, and other researchers at Princeton University demonstrated the ability of a great many different substances to perform as catalysts. Some of these showed that varying degrees of heat and pressure were required, along with the catalyst, to initiate various reactions. It was also demonstrated that the catalysts were capable of initiating two types of reaction. In one case, the catalyst acts as a trigger, setting off a chain reaction that does not further depend on the presence of the catalyst. In the other type, the catalyst is required at all times and its withdrawal results in an immediate slowing of the reaction. Conversely, there are catalysts that can inhibit a chain reaction. Tetraethyl lead, for example, retards the combustion of gasoline, thus reducing detonation and increasing the apparent octane number. (It is interesting to note that the now familiar idea of chain reactions and the means by which they can be controlled were evolved by early theoreticians investigating catalysis. An analogy can be drawn with the electron absorbtion rods used to control modern nuclear piles.)

Hugh Taylor, Dean of the Graduate School, Princeton University, has offered a definition of catalysis. To his way of thinking, a catalyst is a means of controlling deliberate speed. Oxygen and hydrogen in a mixture by themselves combine at so slow a rate that it would take about a million years for an apparent change in volume to take place. Adding one catalyst, say silica, and heat, will increase the deliberate speed of the reaction markedly—the two gases burn to water in a brief span. Incorporating another catalyst, platinum, also increases the deliberate speed, but not to the same extent.

CATALYSIS, as we use it today, makes possible the production of ammonia, the slow oxidation and deterioration of rubber and vegetable oils or the increase in yield of useful substances from petroleum. Often it depends on pumps and compressors and blowers for maximum efficiency. It also presents a challenge to future researchers. We "fix" nitrogen in the presence of a catalyst at a temperature of about 450°C and at pressures of several hundred psi. Yet, a tiny bacteria colony in the nodules of leguminous plants can do the same thing at ambient pressures and temperatures.



### **SAVING WITH AIR POWER**

### **Air Motors In Safety Valve Production**



### INSERTING OPERATION

A nozzle is placed manually in a safety valve (above), and an Ingersoll-Rand Size 55Q air motor is lowered (right). The operator starts the motor, and the nozzle is run into the valve to nearly perfect torque requirements. Air is used at pressures of from 55 to 95 psi.

A WIDE variety of safety valves, ranging in size from 1x1½ to 8x10 inches are manufactured by a New Jersey concern. Nozzles must be inserted in these valves, and they are then hydrostatically tested to assure that they are pressure-tight. The operation was, at one time, manually done by two or three men with a long pipe wrench. Al-



though one unit could be turned out every 5 to 7 minutes, there was a rejection rate of about 3 percent, and back injuries were frequent.

In order to shorten the operation time, eliminate the injury rate and reduce the number of rejected pieces through better quality control, the manufacturer turned to air power. An Ingersoll-Rand Size 55Q air motor was used. It was mounted on a structural steel frame and could be moved up and down by means of a pulley arrangement. The handles of the motor ride in slots in the sides of the frame to guide it and absorb the torque reaction. Thus, only one operator was necessary. A special socket was made available to fit each size nozzle. By running the tool to a stall on a regulated air pressure of from 55 to 95 psi, all sizes of nozzles were driven to nearly perfect torque requirements. During the first 4 months of operation, all rejections were eliminated and quality control was substantially increased. The manufacturer estimated at least a six-to-one ratio in time saved over formerly used hand methods.

### Pneumatic Dunnage Commercially Available

PNEUMATIC dunnage cushions, called Shor-Kwik and developed by United States Rubber Company for the U. S. Army Quartermaster Corps, are now available as a commercial item. They are used to displace wasteful bracing and shoring lumber in many types of shipment. According to a recent publication of the Quartermaster Storage Operations Research Team, they have been found to be safe, efficient and economical for shoring cargo. It tested them in standard-sized boxcars that were loaded with cargo and impacted at varying speeds. The experiments were performed before representatives of both the U.S. Army Transportation Corps and the Association of American

Shor-Kwik consists of nylon bags that have been neoprene coated on each side. They are equipped with butyl-compound bladders, similar to those in a tire inner tube, and large-volume diaphragm valves. When deflated, the units fold into compact 6x15x24-inch packs. Inflated, they measure 4x4 or 4x5 feet and can be inflated to from 1 to 10 pounds per square inch. They have a bearing surface of 40x40 or 40x50 inches, respectively, and their weight varies between 28 and 33 pounds.

In readying a car for shipment, first

the center space, or void, of the loaded boxcar is measured to determine how many Shor-Kwik units will be needed. Then the cushions are partially inflated for greater ease of handling and quick insertion into position. They are set in snugly and inflated to absorb impact and prevent cargo shifting. Practically all damage in rail shipments has been eliminated, and time required for loading and unloading of boxcars has been decreased.

Large, private shippers who have tried the method have been favorably impressed. Container Corporation of America, for example, reported savings of \$11.40 per car by not having to use wooden bulkheads and blocking. Marathon Corporation, Menasha, Wis., claimed shipping costs of carton board averaged \$13.21 less per car, while Masonite Corporation reported a reduction of better than 50 percent in transit damage on hard wallboards.

### Air Honing

PROPELLER blades receive a matte finish in a special liquid honing machine (right) at Trans World Airlines' overhaul base near Kansas City, Mo. Fine silica abrasives, suspended in a liquid medium, are shot in a stream against the blade, giving it a soft, velvety finish. This process removes small nicks the blade might have received in service. A pump maintains complete agitation and suspension of the abrasive particles for uniform and consistent results. It has a capacity of 30 gpm, 24 of which are fed directly into the hopper to create the agitation; the remaining, to the blasting gun where compressed air gives the slurry a high impetus.



### **Industrial Notes**

SIZE 403 Model B is the designation of an automotive air Impactool engineered by Ingersoll-Rand Company. This ½-inch drive unit features a triggermounted Select-air regulator that enables the mechanic to quickly choose the power needed for every job, running small nuts and screws without threadstripping and breakage; as well as a simple-to-operate sliding reverse valve for instant reversing; a protective rub-



ber nose, to seal out dirt; and a contoured handle. The tool is said to be able to handle work up to ½-inch bolt size. Measuring only 6 inches overall, with a 1%-inch side-to-center distance, the tool's impact mechanism converts the full torque of the air motor into powerful rotary impacts, making the toughest job easy.

Circle 1E on reply card

Van Products Company announced its Vi-Speed Dehumidi-Filter, Model 5000, for compressed air systems at the recent Instrument Automation Show. The unit has the capacity to filter 1700 scfm of air at 100-psi pressure. Users having an air supply of up to 425-hp compressor output are said to be able to filter their entire supply of air at one central location, thus eliminating the maintenance of numerous small filters throughout their plants.

Circle 2E on reply card

V ARIOUS heat exchange duties in process industries can be accomplished with a complete range of metal coils offered by Niagara Blower Company. They are made of aluminum, copper and stainless steel, as well as carbon and alloy steels and hot-dipped galvanized steel. Further, they are obtainable in both prime surface and extended surface types and include series flow, serpentine, parallel-flow with special headers, fully cleanable and variously partitioned coils. Each is available with bends to various radii for pressures as great as 3000 pounds. Circle 3E on reply card

PIPING engineers will be interested in two compact, portable tools that quickly roll grooves into lightweight steel and aluminum pipe and tubing without removing any metal. They have been added to the line of pipe groovers developed by the Victaulic Company of America and are designated as Vic-Easy Series 100 and 200. They are readily adjustable from 1½- through 12-inch diameters and reportedly make it easy to groove pipe ends for leak-tight jointing of water, oil, air or other lines with Vic-Easy snap-joint, standard or lightweight couplings. Series 200 is con-



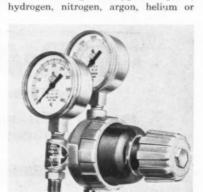
structed for continuous duty on heavy wall thicknesses while the other is a lighter machine for occasional jobs on thinner walls. The user simply sets the pipe between forming rolls, with the end against a pipe stop, and turns down the roller feed screw to proper groove depth. There is no need to measure or gauge dimensions. Operation is either manual, stroking the ratchet handle, or power-operated from a pipe machine, winch or hub drive of field trucks and the like.

Circle 4E on reply card

KEGULATORS specifically engineered to meet the gas flow-rate demands of such operations as heating, heattreating, lead burning, welding, cutting, flushing molten metals, food packing and inert-gas-shielded arc welding, are single-stage, inverse-type units. Manufactured by Air Reduction Sales Company and known as the 8100 Series, each is designed to provide what is said to be a substantially higher delivery rate at

a more constant delivery pressure

whether working with oxygen, acetylene,



### PRESSURE PACKAGE FOR CHARCOAL BRAZIERS

PRESSURE-packaged products are not only growing in volume of sales, but in variety as well. From foods to cosmetics to paints, the list is supplemented every month. Development of suitable containers has also led to some



other interesting consumer "notions." The device illustrated above is a barbecue lighter used to light charcoal in the popular outdoor braziers. Although not technically a pressure packaged product (because the product is also the propel-

lent) the device does represent an application of compressed gas. Safe and easy to use, it eliminates the questionable practice of using flammable fluids to light charcoal. Filled with a liquefied petroleum gas, the Lite-O-Matic, as it is called. contains enough fuel to light about 100 charcoal fires, yet weighs less than 1 pound. The lighter retails for \$3.98, complete with a fuel package. Additional fuel packs are sold for \$0.98 each. In use, the device hooks over the edge of the brazier bowl and charcoal lumps are heaped up around the coiled-wire flame protector. The valve is then turned on and the gas ignited. It burns with an intense (3000°F) blue flame, quickly igniting the surrounding coals. Also available are portable camp-stove, log lighters, etc., all of which operate from the same fuel packages. Lite-O-Matic, Inc., 951 North La Cienga Boulevard, Los Angeles 46, Calif., is the manucarbon dioxide. There is no drop-off in working pressure as cylinder pressure decreases. A ribbed body ring is a feature that makes inspection and maintenance easy. Without tools, the spring case and low-pressure cavity can be opened and the diaphragm removed. The sure-grip brass adjusting knob is a change from the usual T-bar type, and a hexagonal nut projects from the knob end to permit the use of a 6-way wrench.

WHERE a single source of coolant for a group of machines is desired, pneumatically-actuated Standard Graymills Mist Coolant Units are reportedly quickly adaptable. Graymills Corporation's manifolds, each for either one or



two outlets, are connected directly to piping or tubing. Coolant is delivered to the pipe through gravity, a low-pressure supply pump or any other method that merely keeps the line filled. No other pressure is required. Individual control of each outlet is possible by adjusting the individual manifolds. Both air and fluid flow are controlled individually even though the central coolant supply is at uniform pressure.

Circle 6E on reply card

ELECTRICAL selector switches that feature self-wiping contacts have been introduced by the Sel-Set Machinery Corporation. Originally developed for use in sawmill setworks controls, the fixtures are said to work equally well



in any electrical installation requiring heavy-duty controls. Each provides the operator with natural action—all motion is either to, or from, the user. The model in the illustration above has six contacts. Other standard units are available with from four to ten contacts; ones with more than that number can be obtained on order.

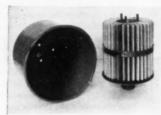
Circle 7E on reply card

A COMPLETE line of vitrified grinding wheels for all types of applications is offered by Simonds-Worden-White Company. To insure what is said to be maximum accuracy and uniform results from wheel to wheel, pressure forming of each is carefully regulated. In addition, the vitrifying steps are carried out under rigid quality-control procedures utilizing precision kiln equipment. The standard sizes range from 3 to 42 inches in diameter with special sizes and shapes produced as required.

Circle 8E on reply card

TYPE X is a right angle conduit pipe hanger that reportedly retains constant effective clamping tension by a spring action that is designed into the saddle. This makes the device extraordinarily safe, it is said, and ideal for heavy-duty industrial applications. Produced by Ramco Manufacturing Company, Type X can be used with standard pipe or EMT conduit for mounting on struc-

### NEW DRY TYPE AIR FILTERS for engines, compressors, blowers and other industrial applications



• Designed for specific applications, the new Air-Maze Dry Type filter is particularly suitable where 1.) oil free air is required, 2.) an extremely high degree of filtration is required, 3.) the air velocity varies from one

period to another and, 4.) the dirt concentration is relatively low, except when vibration is present to help dirt removal.

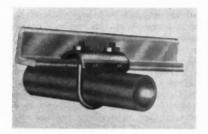
The Air-Maze Dry Filter is one of the most efficient mechanical type filters available. Laboratory tests indicate better than 98% efficiency with particles of 2 micron mean diameter and practically 100% efficiency with particles of 5 microns or larger.

The Air-Maze Dry Filter type DA employs a special highgrade felt filtering media arranged in deep pleats to provide extended area, and armored on both sides by heavy galvanized cloth. Heavy gauge perforated tubing inside the media and a metal strap on the outside form a rigid unit of great strength and are corrosion protected. Made in sizes from 20 cfm to 6650 cfm. Catalog DA-1056 available. Write AIR-MAZE CORPORATION, Cleveland 28, Ohio.



The Filter Engineers

AIR FILTERS • SILENCERS • SPARK ARRESTERS • LIQUID FILTERS
OIL SEPARATORS • GREASE FILTERS



tural flanges up to 7/8-inch thick. Each is available, ready for use, in 3/6- to 2-inch sizes. Circle 9E on reply card

HIGH Pressure Equipment Company, Inc., has developed a high-pressure valve that is so small it can fit inside a tennis ball. Its body is slightly larger than an ordinary postage stamp. The unit was designed for \(^1/6\)-inch tubing and to handle pressures as great as 15,000 psi in pharmaceutical, chemical and petro-



leum fields. The stem is nonrotating and, reportedly, always seats securely. Models are available in stainless steel, Monel or Hastalloy and are said to be adaptable for standard compression, socket weld and IPS connections.

Circle 10E on reply card

TWISTED wire brushes as long as 8 feet, and with diameters ranging from 1/4 to 8 inches, are being manufactured by Mill-Rose Company. They can be used as tube cleaners, turbulators, stirrers, heat exchangers, static eliminators, filters and power brushes for food processing. Single or double spiral type



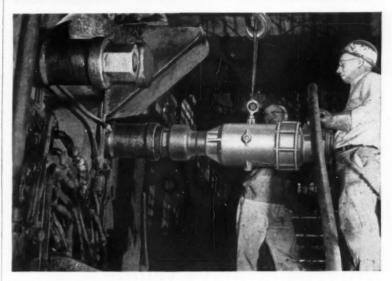
FEBRUARY 1958

# NEW big brother

added to Ingersoll-Rand

Impactool family...

new SUPER SLUGGER 599



This new Giant of Impactools, by the originator of Impact Wrenches, is the biggest and newest member of the Ingersoll-Rand family of 22 sizes of Impactools. It has a 3½" square driver which, with heavy-duty impact sockets, makes an easy, fast, two-man job of loosening or tightening nuts on bolts from 6" to 12" in diameter.

Like all the other 21 sizes of Impactools bearing the I-R trademark, this tool uses the time-proven ball and cam impact mechanism.

Whatever your nut-running problem, you will find the best Impactool to speed the job and cut the cost in the full line of 22 sizes of Impactools bearing the I-R trademark. Ingersoll-Rand, 11 Broadway, New York 4, N. Y.

Ingersoll-Rand

Tools plus AlRengineering
increase output per man

Circle 13A on reply card

# WHEREVER YOU NEED TO COOL A FLUID... and have a problem of water supply or disposal...use NIAGARA "AERO" HEAT EXCHANGER

MIAGARA "AERO"

HEAT EXCHANGER

Evaporating a very small amount of water in an air stream you can cool liquids, gases or vapors with atmospheric air, removing heat at the rate of input, controlling temperature precisely. Save 95% of the cost of cool-

equipment cost.

You can cool and hold accurately the temperature of all fluids, condense

ing water; save piping, pumping and

power. You quickly recover your

vapors, cool water, oils, solutions, intermediates, coolants for mechanical, electrical or thermal processes. You have a closed system free from dirt. You have solved all problems of water availability, quality or disposal, maintenance expense is low.

You may apply this to solvent recovery, vacuum systems controlling reactions, condensing distillates, cooling reflux products.

For more information, write for Bulletins 120, 124, 135. Address Dept.

### NIAGARA BLOWER COMPANY

Dept. CA-2, 405 Lexington Ave., New York 17, N.Y.

Niagara District Engineers in Principal Cities of U. S. and Canada
Circle 14A on reply card

### Aftercooler and Cyclone Separator designed for cleaner, dryer compressed air

R. P. ADAMS CO., INC. 209 East Park Drive, Buffalo 17, New York



The Adams Aftercooler and Cyclone Separator are designed to efficiently condense and remove water from compressed air and process gas. Condensed moisture and entrained dirt and oil are subsequently removed in a cyclone type separator. This unit is scientifically designed for maximum removal efficiency over a wide range of flow rates.

For normal use, units are available to cool gases to within 10° F of the temperature of the cooling water. Specially designed units are available to permit a 2° F approach to cooling water temperature, for application where low moisture content is critical.

**Adams Aftercoolers and Separators** are available from stock to handle 20 - 40,000 cfm with 10° cooling and 25 - 19,200 cfm

where it is necessary to cool within 2°F of the cooling water. Special units can be supplied to suit an unlimited range of requirements. In all cases the maximum pressure loss at rated capacities is ½ psi.

This wide range of sizes enables the economical utilization of Adams Aftercoolers and Separators in virtually all industrial application. For further information on how R. P. Adams' units will solve your compressed air problems and save you money, write today for Bulletin 711.

bristles are available in hog bristle, fiber, nylon, steel, brass, bronze or stainless steel.

Circle 11E on reply card

A LINE of ductile iron diaphragm valves has been announced by Hills-McCanna Company to meet wide requests for units that would have good strength and resistance to fracture and thermal shock. Available as complete valves or replacement components of



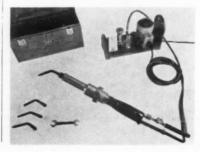
bodies, bonnets and handwheels, the devices may be obtained either with threaded ports (½ to 3 inches) or with flanged ends (½ to 8 inches).

Circle 12E on reply card

Pydraul AC is a fire-resistant synthetic compressor lubricant that minimizes maintenance normally arising from carbon deposits that form on exhaust valves and air-system components. According to the manufacturer, Monsanto Chemical Company, the fluid is equivalent in lubricity to a premium grade oil and conversion from that type to this variety requires only cleaning of splash-lubricated compressors to free them from petroleum deposits. Additional information is available in Technical Bulletin No. 0-133, and samples will be supplied upon request.

Circle 13E on reply card

PLASTIC welding-torches manufactured by D. & R. Plastic Welders, Inc., deliver air at pressures from 5 to 35 psi and temperatures as great as 700°F.



The heated air is directed onto thermoplastic sheets, such as polyethylene or polyvinyl chloride, permitting them to be welded in much the same manner as are steel plates. Two models are available for a wide variety of applications: electric- and gas-heated. The latter unit uses standard gas cylinders and can be easily moved to on-the-job locations. The former can be used in areas where open flames would be dangerous. Both are furnished in a complete kit that contains all the necessary voltage and gas-pressure regulating equipment.

Circle 14E on reply card

SAFETY and a give-away item are combined in low-cost spectacles manufactured by Industrial Products Company. Each comes individually wrapped in a sealed cellophane envelope and will fit anyone, whether or not correction glasses are used. The frame is contemporarily styled and molded of cellulose acetate in an amber color. Lenses are



curved, clear plastic that reportedly has good impact resistance. Because they are inexpensive and can be taken by visitors, the problems of cleaning, sanitizing and repackaging standard safety spectacles are eliminated.

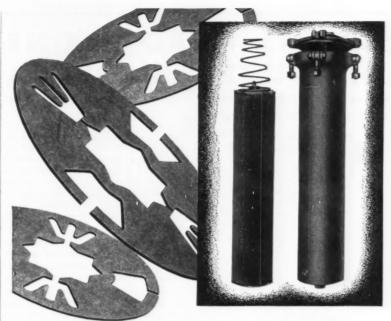
Circle 15E on reply card



#### CLEANING PISTOL

Labor savings as great as 80 percent are claimed for a pneumatically operated cleaning device manufactured by Kemax Corporation. A unique valve arrangement allows the user to switch instantly from a cleaning- or sterilizing-solution application to clear-water pressure-rinse and to air dry if desired. The weight of this pistol-shaped invention is less than 3 pounds. It requires air at pressures of from 100 to 125 psi.

Circle 16E on reply card



### the NUGENT Laminated Disc Filter

This "extended area" filter utilizes an actual filtering surface area greatly in excess of its container area. The Nugent Laminated Disc Filter provides a high flow rate at low pressure drop combined with the extreme fine filtering absorption and neutralizing properties of a depth type filter.

The filter charge consists of a stack of similar crenulated fiber discs, each rotated 45° from the position of the adjacent disc, thus affording proper channeling and maximum filtering capacity. Liquid passes from the exterior to the interior of the filter stack.

The filter recharge has a useful life of from 4 to 10 times that of a cellulose or waste recharge. Changing recharges requires only minutes. Cartridges are interchangeable with all other Nugent bag or depth type cartridges. Write for full details.

#### DESIGN FEATURES

- · Provides "Extended Area" filtering
- · Removes solids as small as 2 microns
- · Removes acid forming contaminants
- · Will not remove additives
- · Contains no chemicals or bleaches
- Working pressure 125 psi—tested to
- High pressure filters to 600 psi tested to 3000 psi
- · Built in by-pass relief
- Maximum operating temperature 375°F.

#### HOW IT WORKS



Each disc in filter stack is rotated 45° from position of adjacent disc for proper channeling and maximum filtering capacity.



PRINCIPAL CITIES

375 psi

WMo Wo NUGENT & GOOD DEGO

OIL FILTERS • STRAINERS • TELESCOPIC OILERS
OILING AND FILTERING SYSTEMS • OILING DEVICES
SIGHT FEED VALVES • FLOW INDICATORS

Circle 16A on reply card

### ADAMS PORO-STONE AIR FILTER designed to remove oil,

water and foreign matter from compressed air lines with minimum pressure drop.



The R. P. Adams Poro-Stone air filter is engineered to efficiently remove entrained oil, water and pipe scale from compressed air lines. Liquid droplets and solids being carried by the gas stream are first removed by centrifugal action in an annular chamber. Secondary filtration is achieved by passing the air or gas stream through a Poro-stone unit. An automatic trap can be provided to discharge the residue from the cyclone chamber.

At rated capacity the filters operate at a maximum pressure drop of only ½ lb., thus insuring delivery of line pressure to the point of consumption. The units require virtually no service or maintenance — thereby insuring continued trouble-free, low cost performance.

ADAMS Poro-Stone air filters are available from stock in sizes to suit your needs. For further information, write today for Bulletin 117, R. P. Adams Co., Inc., 209 East Park Drive, Buffalo 17, New York.

Circle 17A on reply card

### BRIEFS

New shock absorbers have been developed for bulldozers, and they are similar to those used to cushion the landing shock in airplanes. The wheel suspension units consist of only two parts: a stationary cylinder secured to the frame and a moving piston fastened to each wheel. Cushioning can be varied to suit any requirement by regulating the air pressure in the chambers.

In 1958, the use of aluminum in American passenger cars has increased to an average of 52.4 pounds per automobile, 29-percent more than in 1957 models.

In times of rapid research and development programs, language grows so fast, we have trouble in keeping up with new words. As an indication of the size of this problem, the American Society of Mechanical Engineers with the American Standards Association has recently published a dictionary of technical atomic terms consisting of 188 pages.

A mobile oil-drilling platform that can work in water as deep as 600 feet has recently been developed by R.G. LeTourneau, Inc. Formerly, rigs were limited to depths of 100 to 150 feet.

Capac, the name of an automatic electrical system that has been installed on U. S. Navy craft and commercial ships, reportedly protects ships' hulls and propellors from electrolytic corrosion. Future applications may well include oil and radar towers, tidal hydroelectric turbines and pipelines that carry sea water to oil refineries and steam plants.

One of the most severely handicapped drivers in the world received a license from the Swedish government recently, after designing and building an automobile that permitted him to drive without arms.

Sales of reinforced plastics reached the 168 million pound level in 1957, according to a market study conducted by the Reinforced Plastics Division of The Society of the Plastics Industry, Inc. This represents a 20-percent increase over the 140 million pounds reported for 1956.

Armour Research Foundation of Illinois Institute of Technology has reported a catalytic ceramic coating for internalcombustion-engine piston heads that reportedly promises a significant reduction in the amount of carbon monoxide and un-

# NON-FEUDOLL TRADE MARK REGISTERED

### BEST AIR TOOL LUBRICANT

You will achieve increased production at lower maintenance costs if you lubricate your pneumatic tools with "NR" grades of NON-FLUID OIL. NON-FLUID OIL is manufactured in these special "NR" grades for airdriven equipment to provide trouble-free lubrication while automatically protecting against rust and sticking.

NON-FLUID OIL absorbs airborne moisture forming an emulsion that has greater lubricating value than ordinary oils. Furthermore, NON-FLUID OIL has an affinity for metal surfaces—it does not fog and blow out of the exhaust like common lubricants.

Used and recommended by most leading makers and operators of air tools. Test it yourself, for proof. Send for a copy of Bulletin 550 and a free sample of NON-FLUID OIL.

### NEW YORK & NEW JERSEY LUBRICANT COMPANY

292 MADISON AVE., NEW YORK 17, N. Y. WORKS: NEWARK, N. J.

Birmingham, Ala.

Atlanta, Ga. Greenville, S. C.
Columbus, Ga. Chicago, III.
Charlotte, N. C. Sprinafield, Mass

WAREHOUSES Greensboro, N. C.
Greenville, S. C.
Chicago, III.
Springfield, Mass.
St. Louis, Mo.

NON-FLUID OIL is not the name of a general class of lubricants, but is a specific product of our manufacture.

Circle 18A on reply card

burned hydrocarbons in exhaust gas. In addition, it may result in a thermal insulation and greater combustion efficiency.

The world's biggest truck has been built, it is claimed, by the Berliet Company of France. Designed for use in the Sahara Desert, it is 44.3 feet long, 15 feet wide, is powered by a 600-hp diesel engine and has a maximum speed of 29 miles per hour. Its price is \$119,000, and the company is preparing for quantity production.

Sight of an oil tanker sporting a billowing sail isn't born of oil men's yen for the picturesque. The 50-foot-long cylinder of canas, called a windsail, is used to funnel wind down the vessel's empty tanks and dispel gases that have collected in the tanker after she has unloaded her cargo of petroleum.

A unique way of marking pipeline leaks has been developed by patrol pilots. When a leak is spotted, a paper bag full of yellow powder is dropped. The brilliant splash of color clearly marks telltale patches of oil or discolored soil that might otherwise be hidden by grass or be too subtle to be spotted from the ground by repair crews.

According to a B. F. Goodrich Company executive, 63 percent of the new rubber utilized in this country during 1958 will be man-made, a peacetime record. Total synthetic production capacity has risen almost 50 percent since private industry took over government-owned plants some 2 years ago.

The number of licensed drivers of automobiles in the United States today is greater than the population of the country was when the horseless carriage was introduced.

Experiments with water and oil to reduce the cost of transporting the latter are being conducted. When injected into a pipeline, water forms a ring around heavy crude oil so that the water, rather than the crude, contacts the pipe. With reduced friction, less pressure will be needed to keep the oil flowing at a reasonable rate.

Goodyear Tire & Rubber Company has produced a giant hose, 38 inches in inside diameter, that is destined to suck up mud and sand from the bed of the Mississippi River for the U. S. Corps of Engineers. The 20-foot-long tube weighs 8600 pounds and is constructed of steel wire covered with 3000 pounds of rubber.



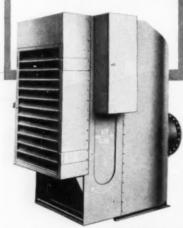
It speaks mighty well for the dependability of Ingersoll-Rand Compressors when we hear so many users say, "We install them . . . start them . . . and forget them except for periodic lubrication!"

That means top satisfaction . . . ample air when needed . . . efficient operation that never lets production lag! That's what you want in your plant. And you get it in every I-R Type 30 Compressor from 1/2 hp through the 20 hp size . . . because they're built with that extra measure of power and ruggedness that assures long life and low maintenance costs. Write for more detailed information on these units for pressures ranging to 250 psi.

# Ingersoll-Rand 11 Broadway, New York 4, N.Y.

Circle 19A on reply card

# AAF Multi-Duty Filters Assure Clean Intake Air Automatically



Type CMS Multi-Duty for air

When your engines and compressors are protected by AAF Multi-Duty Self-Cleaning Filters, you know that intake air is clean.

Uniform air delivery, constant efficiency, low operating resistance and infrequent maintenance are "musts" for true dust protection. Multi-Duty measures up on every count because this filter keeps itself "fit" through continuous self-cleaning action.

Would you like more information? Write today for our 16 page illustrated catalog.



COMPANY, INC.

402 Central Avenue, Louisville 8, Kentucky
American Air Filter of Canada, Ltd., Montreal, P. Q.

Circle 20A on reply card

### **Industrial Literature**

CENTRIFUGAL compressors designed for catalytic reforming are the subject of Form 8277, published by Ingersoll-Rand Company. The units described are capable of handling a wide-volume range of low-density hydrocarbons used in refining processes. They recycle the gases at relatively high pressures and are built in a variety of sizes with either vertically or horizontally split casings. The former can have either top or bottom intake and discharge, while the latter have both connections located in the bottom casing half. A variety of special shaft seals are available, and the driver can be a steam turbine, a combustion gas turbine or a motor-gear combination.

Circle 17E on reply card

A HYDRAULICS and lubrication manual for automated special machine tools is available from Snyder Tool & Engineering Company. It is profusely illustrated with photographs, tables and 2color line drawings of hydraulic circuits. Brief descriptions and over-all illustrations of semi-automated trunnion and rotary-index machines are included along with similar material for automated center-column machines and fully automated transfer-type machine tools. Instructions for general maintenance are discussed along with a detailing of lubricants and a lubrication chart. The final engineering section of the publication deals with three types of standard transfer bar index systems for moving parts or fixtured-parts on transfer-type special machine tools. The booklet has a handy index, all sections of the work being subheaded and referenced to it.

Circle 18E on reply card

ANTI-CORROSIVE Metal Products Company, Inc., has issued a 138-page catalogue that is said to simplify the work of engineers, buyers and cost estimators. It contains price, stock and delivery information on the company's lines of stainless steel and nylon fastenings. The value of this bulletin lies in three facts: (1) net prices are shown for all quantity brackets and all sizes, no computation is necessary; (2) set-up charges and net prices are given on nonstock items; and (3) prices and delivery are given for stainless steel fasteners that are not in common useage. In addition, the company has instituted a service stock list, issued quarterly, showing many thousands of items that are kept ready to cover emergency needs. Circle 19E on reply card

FILTER-FREE air-and-steam cleaners, manufactured by The V. D. Anderson Company, are detailed in a 4-page bulletin (No. 502). These units operate

### ECONOMICAL COOLING OF GASES and COMPRESSED AIR



• Cooling gases or cooling and removing moisture from compressed air, the Niagara Aero After Cooler offers the most economical and trustworthy method. Cooling by evaporation in a closed system, it brings the gas or compressed air to a point close to the ambient temperature, effectively preventing further condensation of moisture in the air lines. It is a self-contained system, independent of any large cooling water supply, solving the problems of water supply and disposal.

Cooling-water savings and power-cost savings in operation return your equipment costs in less than two years. New sectional design reduces the first cost, saves you much money in freight and installation labor and in the expense of upkeep.

Niagara Aero After Cooler systems have proven most successful in large plant power and process installations and in air and gas liquefaction applications.

Write for Descriptive Bulletin 130

### **NIAGARA BLOWER COMPANY**

Dept. C A - 2, 405 Lexington Ave. NEW YORK 17, N. Y.

District Engineers in Principal Cities of U.S. and Canada

Circle 21A on reply card

without moving parts, filters or baffles, thus preventing clogging, loss of pressure and eliminating all maintenance problems, it is said. Called Hi-eF Model LC Purifiers, these devices are installed as a fitting on compressed-air pipelines, just before pneumatic equipment such as hammers, wrenches, nut runners, sand blasting equipment, and so forth. They are also used on small steam lines to prevent moisture and other harmful entrained deposits from damaging heat exchangers, vacuum canners, generators, drums, ejectors, kettles, turbines and Circle 20E on reply card the like

AIRLESS blast cleaning machines as well as wet-blast, air-blast and dustcontrol equipment are detailed in a 32page illustrated catalogue (No. 951-D) published by Wheelabrator Corporation, 1218 South Byrkit Street, Mishawaka. Ind. Also included is a listing of the manufacturer's Super Tumblasts, heavyduty, high-efficiency, batch-type centrifugal blast-cleaning machines that are available in three sizes. Reference is made to specific literature covering each of the individual pieces of equipment. All publications can be obtained by writing to the concern on company letterhead.

BULLETIN SC-1013 describes dehydrators designed and built by Selas Corporation of America to meet specific needs for effective and economical removal of moisture from all gases. Moisture removal and discharge from the system is continuous, with no flow interruption or interference. Gas inlet pressures may range to 150 psig for standard design and to 3500 psig or more for special applications. Reportedly, outlet dewpoint is maintained safely below the specified level, which can run to a minus 100°F.

Circle 21E on reply card

COMPLETING 60 years of service to industry, Wm. W. Nugent & Company, Inc., has published a 24-page brochure that details its history. It is a well illus-



"And don't get the idea you're indispensible around here.





### "HARDROK" Gir Hose

There are two good reasons why "HARDROK" stand out wherever it is used...its black-striped yellow cover and its unequalled performance in the toughest applications...drills, jumbos and other air equipment.

Carcass is made of horizontally braided steel wires, providing exceptional strength, durability and resistance to kinking without impairing flexibility. Tube is long-lasting synplastic<sup>®</sup>, impervious to action of oil. Cover is tough, wear-resistant rubber... yellow with black spiral stripe to identify the hose that means longer service life, lower replacement costs. Sizes 1/2" to 3", inclusive.

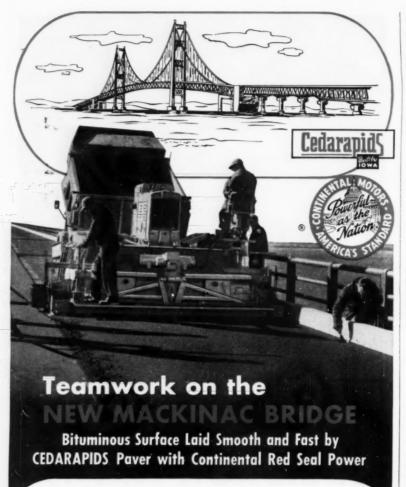
### "If it's GOODALL, it MUST be GOOD!"

Contact Our Nearest Branch or Write for Catalog

HOSE . BELTING . FOOTWEAR . CLOTHING AND OTHER INDUSTRIAL RUBBER PRODUCTS

### Pubber Company

GENERAL OFFICES, MILLS and EXPORT DIVISION, TRENTON, N. J. BRANCHES AND DISTRIBUTORS THROUGHOUT THE UNITED STATES. IN CANADA: GOODALL RUBBER CO. OF CANADA LTD., TORONTO.



This \*Cedarapids Paver, surfacing Michigan's new Mackinac Bridge, is another fine example of teamwork between Continental Motors and leading builders of specialized machines. The job presented tricky problems, but the paver took them all in stride. In the bridge's length of nearly five miles are some 80 expansion joints, each with steel lips extending 11/2 inches above the concrete bridge floor. Cedarapids' unique oscillating track rollers enabled the new paver to pass over the joints without disturbing the screed, and once under way, the work proceeded at 32 fpm.

\*Product of Iowa Mfg. Co., Cedar Rapids, Iowa.

CEDARAPIDS PRESENTS ANOTHER STRIKING PROOF OF THE STATEMENT: ANY EQUIPMENT IS BETTER EQUIPMENT WITH DEPENDABLE RED SEAL POWER

WORLD'S LEADING INDEPENDENT MANUFACTURER OF INTERNAL COMBUSTION ENGINES. CONTINENTAL MOTORS OPERATES PLANTS IN ATLANTA, DALLAS, DETROIT, MILWAUKEE. MUSKEGON, AND TOLEDO, AND IN ST. THOMAS, ONT., PRODUCING AIR-COOLED AND LIQUID-COOLED ENGINES FOR USE ON LAND, AT SEA AND IN THE AIR.

Continental Motors Corporation

pieces of equipment manufactured by various concerns and using Nugent oil filters, strainers, flow indicators and similar devices. Of particular interest is a 2-page section that tells the story of its famous trademark. Circle 22E on reply card

trated bulletin showing many early

STEAM traps of the inverted openfloat type are discussed in a flyer issued by Crane Company. It includes tables and instructions for selecting traps for any condensate discharge condition. The units range in size from 1/2 to 1 inch and in working pressures from 1 to 300 pounds saturated steam. Recommendations for proper installation, as well as a table of dimensions for the complete line are given.

Circle 23E on reply card

RUBBER-PARTS production facilities of E. F. Houghton & Company are outlined and typical moulded parts are illustrated in Precision Parts of Moulded VIX-SYN Synthetic Rubber. Some of its services, such as design, compounding, laboratory work and mould storage, which the supplier makes available to users of rubber mouldings, are given.

Circle 24E on reply card

AIR-VAC is the name of a hand-operated industrial cleaner that is manufactured by Frederick Tool & Engineering Corporation. Reportedly, it fits any standard air hose and operates at a pressure of 90 psi for either wet or dry pick-up applications. The unit and its attachments are described in a 4-page flyer published by the manufacturer.

Circle 25E on reply card

INDUSTRIAL Chemical Sales Division of West Virginia Pulp & Paper Company has published Powdered Activated Nuchar for Purification and Reclamation. It offers helpful hints on the use of Nuchar for the removal of impurities and objectionable taste and odors, and on its ability to absorb desirable materials which are to be recovered.

Circle 26E on reply card

WHEN and how to grind and how best to select grinding wheels for resharpening percussion and rotary rock-drill bits, are questions answered in Bay State Abrasive Products Company's 6-page brochure. In addition, general recommended specifications for machine-grinding rock-drill bits are given.

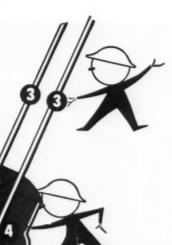
Circle 27 E on reply card

SHEET packing for handling liquids, gases and abrasives is described in a 4-page bulletin published by B. F. Goodrich. Besides data and specifications, the catalogue illustrates the material and describes its use.

Circle 28E on reply card

If You Use Blasting Caps

# **EXAMINE** THESE **FEATURES**



- DEPENDABLE FIRE-Special alloy is used as the bridge wire in the firing element of Hercules Electric Blasting Caps. Wire is noncorrosive.
- ENGINEERED SHELL-Bronze shell of a Hercules cap goes through fifteen separate operations while it is being expertly shaped.
- TOUGH, HIGH DIELECTRIC INSULATION -Leg wires of Hercules caps are coated with plastic insulation for outstanding toughness, resistance to abrasion, superior dielectric qualities.
- SECURELY ANCHORED-A cast sulfur plug in the upper part of shell anchors entire firing mechanism in place.
- WATERTIGHT WATERPROOFING-A special Hercules waterproofing formulation minimizes the possibility of moisture or dampness penetration.
  - DOUBLE-PACKED WALLOP-Bridge wire extends into the priming charge and makes positive contact to give rapid ignition.

HERCULES BLASTING CAPS

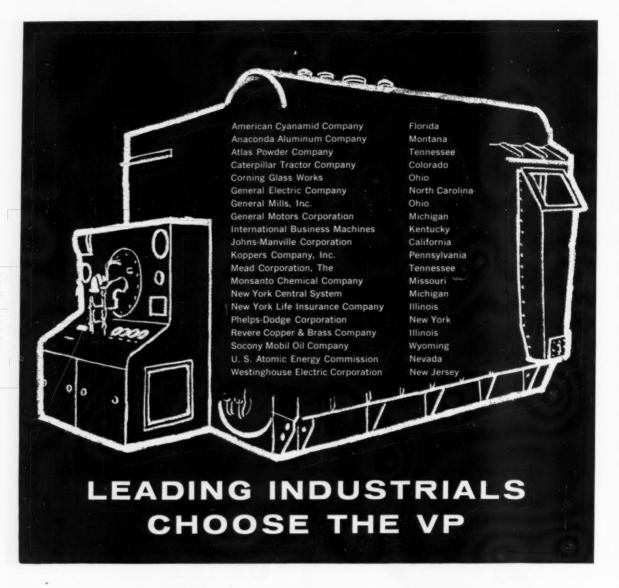
Partners in Dependability with Hercules® Explosives

HERCULES POWDER COMPANY

Explosives Department: 900 Market Street, Wilmington 99, Delaware Birmingham, Chicago, Duluth, Hazleton, Joplin, Los Angeles, New York, Pittsburgh, Salt Lake City, San Francisco



FEBRUARY 1958



Not only do many of the nation's leading industrial companies—such as those listed above—buy VP Boilers, but also a long list of smaller companies and institutions have VP package boiler installations.

The choice of the "big" companies, however, has some special significance. They buy boilers frequently—therefore, their experience is always up to date. They buy them in all capacities large and small. Their requirements justify employment of highly qualified engineering specialists — both staff men and outside consultants. Thus, they have the breadth of experience and the expert guidance requisite to making the soundest equipment selections.

So—if you are in the market for boilers in the capacity range from 4,000 to 50,000 pounds of steam per hour, we submit that you can buy with confidence the boiler chosen by so many of the nation's largest industrialists—the C-E Package Boiler, Type VP. A new descriptive catalog, VP-3, is just off the press. Write for your copy.

### COMBUSTION ENGINEERING

Combustion Engineering Building . 200 Madison Avenue, New York 16, N.Y.



# PRIVATE LINE for CONTRACTORS!

There's versatility and extra performance in NAYLOR pipe lines—to meet all your requirements.

For dredging operations. For tunnel ventilation. For de-watering and drainage. For hydraulic sluicing. For air to operate pneumatic tools. For water lines. For materials handling.

Light in weight, but extra strong and safe in service, NAYLOR Spiralweld pipe is easy to handle and install. Lines can be made up faster, too—especially when you use the one-piece NAYLOR Wedgelock coupling to speed connections.

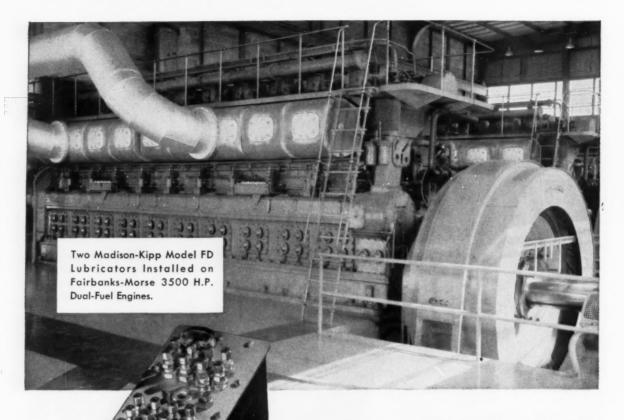
It's this all-around dependable and economical performance that has made NAYLOR the stand-by for contractors.

For complete details, write for Bulletin 507.

## NAYLOR

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Machines of great performance use the most dependable oiling system ever developed MADISON-KIPP

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finest machine tools, work engines and compressors. You will
definitely increase your production potential for years
to come by specifying Madison-Kipp on all new machines you buy,
where oil under pressure fed drop by drop can
be installed. There are 6 models to meet almost every
installation requirement.



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Skilled in Die Casting Mechanics • Experienced in Lubrication Engineering • Originators of Really High Speed Air Tools

# Spanning the Great Salt Lake... Excavating fill for 13-mile causeway Assigned to 6 Bucyrus-Erie electrics



Three Bucyrus-Erie 150-B electric shovels with 8-yd. dippers are loading sand and gravel from one of the borrow areas.

Morrison-Knudsen, Inc., contractors, chose six Bucyrus-Erie 150-B electric shovels to handle the digging on the Southern Pacific's new causeway across Great Salt Lake.

On this 45-million dollar job, 32 million yards of gravel and rock fill material must be dug.

The construction schedule calls for excavation and placement of 1,200,000 yards of earth and rock fill per month. Each of the six 150-Bs often moves 10,000 tons of sand and gravel or rock per 8-hr. shift.

Three 150-Bs load sand and gravel in a borrow area. Three others load large rock from two quarries. In addition, an 88-B with 4-yd. dipper loads in a third quarry. And there's a 71-B serving as a crane or dragline as the work demands.

For the big jobs — where material to be moved is measured in "boxcar" figures — look to Bucyrus-Erie. Other successful contractors do. Call or write for full information.

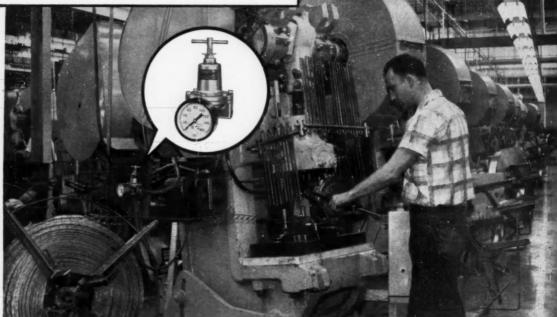




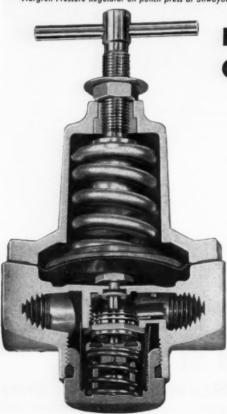
A Familiar Sign at Scenes of Progress

BUCYRUS-ERIE COMPANY . SOUTH MILWAUKEE, WISCONSIN





Norgren Pressure Regulator on punch press at Shwayder Brothers, Inc., maker of Samsonite Luggage.



# Reduce Air Costs . . . Cut Maintenance Costs

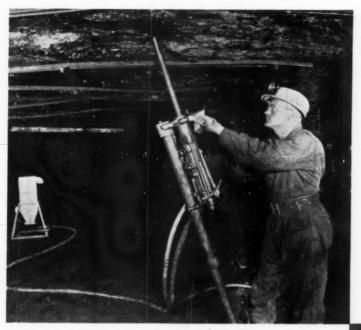
For any air operated equipment, there is one pressure at which it is designed to operate most efficiently. Above that pressure, equipment will wear excessively with no significant increase in output, and compressed air will be wasted. No matter what the application, you can choose a Norgren Pressure Regulator that will reduce line pressure to the desired working pressure. Results will include longer equipment life, lower maintenance costs, less down-time and savings in compressed air costs.

- Norgren Pressure Regulators are Highly Accurate over a wide operating range.
- Regulated Pressure is Held Constant even with widely fluctuating line pressure and rapidly varying air flow.
- Flow Capacity is Large—a. Balanced valve construction; b. Large effective
  diaphragm area; c. Improved baffle and siphon performance; d. Large passages; e. Large valve openings.
- Choice of Relieving or Non-Relieving Regulators.

For complete information on all your regulator needs 1/2" to 2" inclusive, call your nearby Norgren Representative listed in your telephone directory—or WRITE FACTORY FOR NEW No. 900 CATALOG.

### C. A. NORGREN CO.

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from

It's the sensational

# VACUJET ROOF BOLTING DUSTLESS STOPER

with built-in JET SUCTION and PRESSURE DISCHARGE

In the new RP38E VACUIET dustless stoper, Ingersoll-Rand has perfected the first practical solution to the problem of dust control for roof bolting and other up-hole drilling operations. It's the only stoper that offers you all these important advantages.

Strong Suction Power - vacuum-producing jet ejector built into drill backhead. Can even drill horizontal holes!

Dust Discharged Under Pressure - to a distance of up to 25 ft from drill. Uses ordinary air hose.

Low-Cost Dust Collector - a simple filter and receptacle is all that's required. Even a canvas bag will do.

Quieter Operation - no unnecessary ear-splitting whine or howl in dust collection.

Highest Drilling Speed - because stronger vacuum and larger dust ports assure non-clogging operation.

Lower Bit, Rod and Shop Costs - tapered bit and rod connections eliminate need for furnaces, threading and forging equipment.

For the complete story on this revolutionary new VACUJET stoper, call your I-R man or send today for Bulletin No. 4195.

COMPRESSORS . CARSETS BITS . ALLOY RODS . HYDRA-BOOM JUMBOS HOSE . JACKDRILLS . IMPACTOOLS

# DEPENDABLE PNEUMATIC SERVICE



### WHEN EQUIPMENT IS PROTECTED BY

# A COMPLETE SELE-CONTAINED UNIT



DriAir may be installed by suspending it from the piping, without any other support, or may stand on the floor near equipment being protected.

DRIAIR speeds production by separating and automatically ejecting the condensed water and

oil from the air. DriAir collects dirt and rust from the air lines and delivers clean dry air to the tools, thus reducing wear and prolonging their life. All internal parts are made of bronze or copper—resistant to corrosion and practically permanent. Copy of Bulletin DA fully describing the operation of DriAir sent on request.

### NEW JERSEY METER COMPANY

PLAINFIELD, NEW JERSEY

Circle 31A on reply card

## Complete information on pump design and application . . . NEW SECOND EDITION

By A. J. Stepanoff
Development Engineer
Ingersoll-Rand
Company



### CENTRIFUGAL and AXIAL FLOW PUMPS

### Keeps pace with progress . . .

This new edition has been revised and expanded to reflect the significant advances in recent years in the field of centrifugal pumps. During this period the application of such pumps has been extended to many new fields, while the ranges of head per stage, total pressure, temperature, speed, and size have moved to new high levels. Great progress has also been achieved in the theoretical aspects and design procedure based on a better understanding of the flow processes through the parts comprising a centrifugal pump. This book provides the modern treatment needed in view of these important developments.

### Clear, logical approach . . .

The unique method of attack employed in the first edition proved highly successful and has been retained in the current version. It is based on: a single pattern of flow; identical theoretical reasoning; and similar design procedure for centrifugal, mixed flow, and axial flow pumps. As a result the important design elements and performance characteristics are incorporated in a single chart covering all important design elements.

### Features of the 2nd edition . . .

- New material on centrifugal-jet pump systems
- · Chapter on water-hammer problems
- A concise account of progress in water storage pumps
- New charts relating to impeller design for any discharge angle
- . . . and many others

1957. 462 pages.

\$12.00

For Sale By:

### **COMPRESSED AIR MAGAZINE**

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### QUICK-CONNECTIVE TWO-WAY SHUT-OFF COUPLINGS

Both ends of line are positively sealed when you disconnect a Hansen Series HK Two-Way Shut-Off Coupling. To connect, just pull back sleeve and push Plug into Socket. To disconnect, merely pull back sleeve. No tools required. Identical valves in Socket and Plug permit free flow of gas or liquid when Coupling is connected—practically eliminate spilling of liquid or escape of gas when disconnected.

REPRESENTATIVES IN PRINCIPAL CITIES

### WRITE FOR THE HANSEN CATALOG

Here's an always ready reference when you want information on couplings in a hurry. Lists complete range of sizes of Hansen One-Way Shut-Off, Two-Way

Shut-Off, and Straight-Through Couplings—including Special Service Couplings for Steam, Oxygen, Acetylene, etc.



**SINCE 1915** 



QUICK-CONNECTIVE FLUID LINE COUPLINGS

### MANUFACTURING COMPANY

4031 WEST 150th STREET

CLEVELAND 11, OHIO



### CONOFLOW **ALL-BRASS** AIR FILTER

### CORROSION RESISTANT SMALL AND EFFICIENT

Ideal for pneumatically operated instruments, air tools and spray equipment. Uses a Skinner ribbon type filter medium guaranteed to remove dirt particles as small as 40 microns. Easy to clean and maintain. All-brass construction, unaffected by oil or water accumulation. Available with 1/4" connections and wall mounting bracket.

Supplied with areas of 5, 9 or 27 sq. in. The standard model (5 sq. in. area) handles the average pneumatic controller with air consumption from .1 cfm to 5 cfm. Write for BULLETIN H-2.

Cone Controls FOREMOST

WRITE FOR BULLETIN H-2 ON PNEUMATIC REGULATORS

### CONOFLOW CORPORATION SUBSIDIARY OF WALWORTH COMPANY 2100 ARCH STREET . PHILADELPHIA 3, PA.

Circle 33A on reply card

### NO MOISTURE OR DIRT **GETS BY HERE**

Johnson Self-Draining Compressed Air Separator.....

Like all Johnson Separators the new Type "SA" Self-Draining Separator combines the two most effective principles of removing moisture and dirt from compressed air:

1. Controlled expansion of air in separator precipitates most of the moisture.

2. A "thousand baffles" of coarse mesh repeatedly changes flow of direction to capture remaining for-eign matter.

Self-Draining—a simple but complete trap mechanism built right in, automatically drains separator whenever necessary.

WRITE FOR CATALOG lohnson orporation

830 WOOD STREET

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Devices Separation
Separato include
Comprate of s for
Seaan, After Cool.
absorbers,

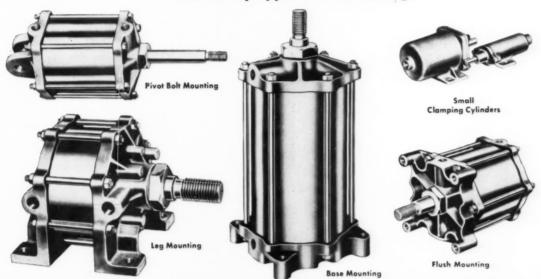
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push, pull, single or double-acting, with or without cushion
. . . for every type and mounting

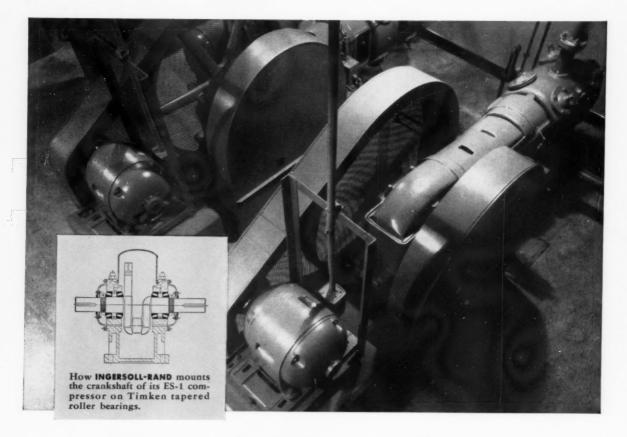




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QUALITY AIR CONTROL PRODUCTS



### Oil research lab keeps air flow up, maintenance down with compressor crankshafts on TIMKEN® bearings

TO assure a continuous flow of compressed air for instruments used in research at an oil company laboratory, Ingersoll-Rand mounts the crankshaft of this ES-1 compressor on Timken® tapered roller bearings.

With Timken bearings, friction is virtually eliminated. That's because Timken bearings are designed by geometrical law to have true rolling motion, and they're precision manufactured to live up to their design.

Timken bearings keep shafts and adjacent parts in positive alignment, keeping wear and downtime to a minimum. They hold shafts concentric with their housings, making closures

more effective. Lubricant stays indirt and moisture stay out.

What's more, because of their tapered construction, Timken bearings take both radial and thrust loads in any combination. And full line contact between rollers and races gives them extra load-carrying capacity.

For rugged dependable performance with minimum wear, you can't beat Timken tapered roller bearings. We even make our own steel—an extra step we take to safeguard quality.

Next time you buy or build a compressor, insist on Timken bearings. They'll help you get the best possible service from your new machine. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".



This symbol on a product means



TIMKEN

TAPERED ROLLER BEARINGS ROLL THE LOAD

TRADE-MARK REG. U. S. PAT. OFF.

Circle 36A on reply card